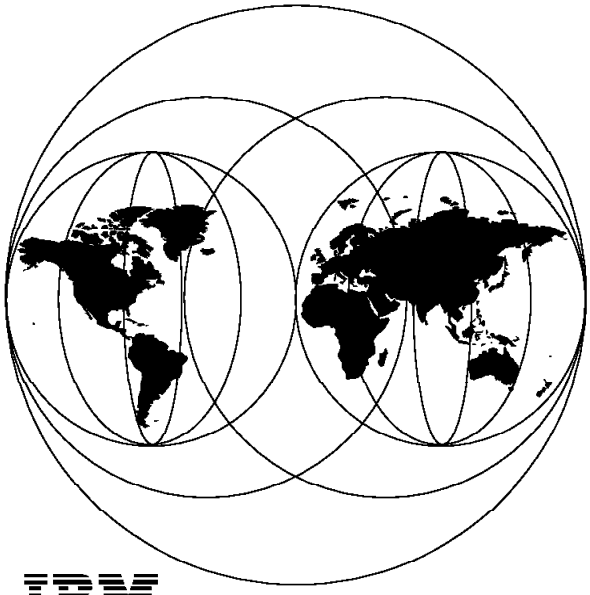
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AS/400 and Novell NetWare Interoperation

December 1997



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AS/400 and Novell NetWare Interoperation

December 1997



Take Note!

Before using this information and the product it supports, be sure to read the general information in Appendix A, “Special Notices” on page 205.

First Edition (December 1997)

This edition applies to Version 3, Release Number 2 of NetWare Integration for OS/400, Program Number 5763-SA3 for use with the Operating System/400, 5763-SS1 and Version 3, Release Number 7 of NetWare Integration for OS/400, Program Number 5716-SA3 for use with the Operating System/400, 5716-SS1. The parts about Enhanced NetWare Integration for OS/400, 5716-SS1, Option 25 only apply for use with the Operating System/400, 5716-SS1, Version 3 Release 7.

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Contents

Preface vii
The Team That Wrote This Redbook vii
Comments Welcome viii

Part 1. Introduction 1

Chapter 1. Overview 3
1.1 The Integrated PC Server 3
1.2 Advantages of Using an Integrated PC Server 4
1.3 Integration for NetWare 4
1.4 OS/400 Enhanced Integration for Novell NetWare 5
1.5 Integration Services for FSIOP 6
1.6 Workstation Clients 6
1.7 IPX Support 6
1.8 Hardware and Software Requirements 6
1.8.1 AS/400 Hardware Requirements 7
1.8.2 AS/400 Software Prerequisites 8
1.8.3 Novell NetWare Server 9
1.8.4 NetWare Server Hardware Requirements 9

Chapter 2. IPX Support 11
2.1 IPX Architecture Overview 11
2.1.1 IPX - Internetwork Packet Exchange 12
2.1.2 SPX - Sequenced Packet Exchange 12
2.1.3 RIP - Routing Information Protocol 12
2.1.4 SAP - Service Advertising Protocol 13
2.1.5 NLSP - NetWare Link Services Protocol 13
2.1.6 NCP - NetWare Core Protocol 13
2.2 IPX Addressing 13
2.3 AS/400 IPX Implementation 14
2.3.1 AS/400 IPX Configuration 15
2.3.2 AS/400 IPX Description 15
2.3.3 AS/400 Line Descriptions 17
2.3.4 IPX Circuit for LAN 18
2.3.5 IPX Circuit for WAN 21
2.3.6 Circuit Route and Service Information 22
2.4 IPX Routing: Matching Parameters for IPX 25
2.5 Operating IPX 26
2.5.1 Starting and Ending IPX Support 26
2.5.2 WRKIPXSTS - Work with IPX Status 27

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2.5.3 Display IPX Service Information 28
2.6 Additional Considerations 29

Chapter 3. Novell NetWare Directory Services 31
3.1 Why Directory Services? 31
3.2 NetWare Directory Services 31
3.3 NDS Tree 32
3.3.1 Root Object 33
3.3.2 Container Objects 34
3.3.3 Leaf Objects 35
3.4 Naming Conventions 35
3.4.1 Distinguished Name 35
3.4.2 Relative Distinguished Name 35
3.4.3 Common Names 36
3.4.4 Name Types 36
3.5 Object Properties 36
3.6 NDS Security 37
3.6.1 Object Rights 37
3.6.2 Property Rights 37
3.6.3 Inherited Rights 38
3.6.4 Effective Rights 38

Part 2. Setting Up NetWare on an AS/400 Integrated PC Server 39

Chapter 4. Installing Novell NetWare on the AS/400 CISC Platform . . . 41
4.1 Preparing for the Installation 41
4.2 The Installation Process 42
4.3 Before You Run INSNTWSVR 44
4.4 Run the INSNTWSVR Command 49
4.5 The Workstation Part of the Installation 50
4.5.1 Installation Steps 50
4.6 Additional Software to Install 54
4.6.1 The NetWare Remote Console (RCONSOLE) Function 55
4.6.2 Additional Installation Steps 55

Chapter 5. Installing Novell NetWare on the AS/400 RISC Platform . . . 61
5.1 Preparing for the Installation 61
5.2 Installation Process 62
5.2.1 Before You Run INSNTWSVR 63
5.2.2 Run the INSNTWSVR Command 68
5.3 Additional Software to Install 70
5.3.1 The NetWare Remote Console (RCONSOLE) Function 70
5.3.2 Additional Installation Steps 70

Part 3. Enhanced Integration for Novell NetWare 75

Chapter 6. Description 77
6.1 The Example Environment 78

Chapter 7. Initial Setup Steps 79
7.1 Installation of the Enhanced Integration on the AS/400 79
7.2 Installing the Enhanced Integration NLM 80
7.2.1 Verifying that the Enhanced NLM is Running 87

Chapter 8. Integrated Security 89
8.1 Connections to NetWare 90
8.2 System Value QRETSVRSEC 94
8.3 Authentication Entries 94
8.4 User Enrollment for Propagation and Synchronisation 96
8.4.1 Setting Up User Profile QNETWARE 96
8.4.2 The Network Server Attributes 101
8.4.3 The Network Server User Attributes 104

Chapter 9. Administration 109
9.1 Submit a Command to a NetWare Server 109
9.1.1 Work with NWS Enrollments 113
9.1.2 Work with NetWare Connections 115
9.2 Server Administration 118
9.2.1 Working with Storage Spaces 118
9.2.2 Working with NetWare Volumes 122

Chapter 10. Printing Integration 127
10.1 Setup Steps 128
10.1.1 AS/400 Tasks 129
10.1.2 NetWare Tasks 131

Chapter 11. File System Integration 141
11.1 The QNetWare File System Architecture 142

Part 4. Special Topics 147

Chapter 12. Backup/Restore Options 149
12.1 Overview 149
12.2 Save/Restore NWS Storage Space 150
12.3 Save/Restore Data to AS/400 Tape Using ″Tape Pipe″ 151
12.3.1 What is Tape Pipe Support? 151
12.3.2 How Does Tape Pipe Work? 153

12.3.3 Activating the Tape Pipe Support 153
12.3.4 Using the Tape Pipe with SBACKUP 155
12.3.5 Using Tape Pipe with Cheyenne ARCserve 6 for NetWare . . 157
12.3.6 Streamlining Tape Pipe Operation 158
12.4 Save/Restore Data Using Network Tape Drive 164
12.5 Save/Restore Data Using ADSM 166
12.6 Save/Restore Data Using AS/400 IFS 166
12.6.1 How Is It Done? 167
12.7 Save/Restore Considerations 173
12.7.1 Performance Considerations 175

Chapter 13. Installing Applications on Integrated PC Server 177
13.1 Installing the Novell NetWare Online Documentation 177
13.2 Installing Cheyenne ARCserve 6 for NetWare 180

Chapter 14. OS/400 Integration for Novell NetWare and Novell NetWare 4.11 191
14.1 New Installation of Novell NetWare 4.11 on an Integrated PC Server 191
14.2 Upgrading Integrated PC Server from Novell NetWare 4.10 to Novell NetWare 4.11 193
14.2.1 Upgrade Process for OS/400 V3R7 195
14.2.2 Upgrade Process for OS/400 V3R2 201

Appendix A. Special Notices 205

Appendix B. Related Publications 207
B.1 International Technical Support Organization Publications 207
B.2 Redbooks on CD-ROMs 207
B.3 Other Publications 207

How to Get ITSO Redbooks 209
How IBM Employees Can Get ITSO Redbooks 209
How Customers Can Get ITSO Redbooks 210
IBM Redbook Order Form 211

Index 213

ITSO Redbook Evaluation 215

Preface

This redbook addresses the different ways to provide inter-operation between the Operating System/400 and Novell NetWare. It describes the various ways to set up NetWare on an AS/400 Integrated PC Server and provides details on the different integration functions such as:

- Disk serving
- Integration of NetWare based data within the AS/400 Integrated File System
- Integrated Security
- User Profile Integration
- Printing AS/400 output on NetWare based printers
- Connection and volume management

This redbook was written for IBM and Business Partners technical specialists who want to provide service to their customers in the area of OS/400 and NetWare inter-operation.

Several practical examples are presented to demonstrate how to set up NetWare on an AS/400 Integrated PC Server both on the AS/400 CISC and RISC platform, as well as setting up the system for end user transparency.

Some knowledge of the AS/400 system and Novell NetWare 4.x. is assumed.

The Team That Wrote This Redbook

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 `redbook@vnet.ibm.com`

Part 1. Introduction

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Chapter 1. Overview

This chapter provides an overview on the various ways to run Novell NetWare on the AS/400 Integrated PC Server and extend the integration into NetWare based networks.

1.1 The Integrated PC Server

The Integrated PC Server (also known as FSIOP - File Server I/O Processor) is a dual purpose adapter, providing standard AS/400 communications over Systems Network Architecture (SNA), Transmission Control Protocol/Internet Protocol (TCP/IP), and Internetwork Packet Exchange (IPX) in addition to providing file serving.

The 6506 Integrated PC Server has an Intel 486 DX2 66MHz processor that is used for file serving. This Integrated PC Server supports from 16MB up to 64MB of memory. Each 6506 Integrated PC Server can have a maximum of two LAN adapters. These adapters can be configured using software for either Ethernet or token-ring and are sometimes referred to as ports.

The 6616 Integrated PC Server has an Intel Pentium 166MHz processor. This Integrated PC Server supports from 32MB to 256MB of memory.

The 2850 Integrated PC Server has an Intel Pentium 133MHz processor. This Integrated PC Server supports from 32MB to 128MB of memory and can only be used on AS/400 Advanced Entry.

The 6616 and 2850 Integrated PC Servers support up to two LAN adapters (or ports) in any of the following combinations:

- Two Ethernet ports
- Two token-ring ports
- One Ethernet port and one token-ring port
- One Ethernet port
- One token-ring port

Both the 6616 and 2850 Integrated PC Servers also have one parallel and serial port. Neither of these ports are supported by NetWare for printing or communications. However, the parallel port supports a hardware license plug that is used by some NetWare NLMs. The LAN adapters for the 6616 and 2850 are separately orderable.

Integrated PC Server performance is enhanced with the use of an Intel i960 (for 6506 Integrated PC Server) or a PowerPC 403 (for 2850 and 6616

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Integrated PC Servers) processor and to a lesser extent, the AS/400 main central processing unit (CPU).

Approximately 11MB of memory when configuring one adapter and 14MB of memory when configuring two adapters is not available for NetWare 4.1 to use. For example, if you have 64MB of memory and have one adapter, NetWare has approximately 53MB available for its use.

To determine the amount of disk storage you can attach and to help calculate your memory requirements, see the *NetWare 4.1 Installation and Upgrade* book.

1.2 Advantages of Using an Integrated PC Server

The Integrated PC Server provides several advantages over adding additional PC servers to your network. These advantages can be summarized in two typical environments. The first is where you have an AS/400 system today in a network that includes PC-based servers. Using an Integrated PC Server allows you to extend the reliability of your AS/400 system into the network, using the AS/400 system to hold the critical file server data in your network. You can add the advantages of AS/400 disk mirroring to your network and use AS/400 backup devices for your network data.

The second typical environment to consider the Integrated PC Server is where you have a smaller branch office with limited NetWare and AS/400 file serving requirements. Here the combination of NetWare and the AS/400 system in a single hardware package simplifies remote administration and management. Finally, you can add the integration of NetWare and the server with AS/400 IPX support, which allows for wide area network (WAN) routing.

1.3 Integration for NetWare

- Provides support to run a standard version of NetWare 4.1 that, with V3R7, can be installed directly from an AS/400 integrated CD-ROM. (For V3R1 and V3R2, a workstation-based install procedure is required.)
- NetWare 4.10 is supported on V3R1, V3R2, and V3R7. IntranetWare (NetWare 4.11) is supported on V3R2 and V3R7.
- Provides file-serving support. Disk space is assigned to the server from the AS/400 system; then partitions and volumes are created using standard NetWare utilities.

- Provides print-serving support. You can use NetWare print serving for your workstation or network-attached PC printers.
- Provides file-serving performance competitive with PC-based servers.
- Runs NetWare 4.1 certified NetWare Loadable Modules (NLMs) that support token-ring and Ethernet.
- Allows you to manage your server on an AS/400 system using standard NetWare utilities such as RCONSOLE from a NetWare client PC.
- Support for up to 16 Integrated PC Servers depending on AS/400 model.

OS/400 Integration for Novell NetWare allows you to do these tasks by installing and running Novell NetWare on an Integrated PC Server. The Integrated PC Server is also known as a File Server Input/Output Processor (FSIOP) within the AS/400 system.

1.4 OS/400 Enhanced Integration for Novell NetWare

OS/400 Enhanced Integration for Novell NetWare provides NetWare services for AS/400 operators and users, linking them to either PC-based or Integrated PC Server-based NetWare servers. You can simplify network user management tasks with user profile propagation, allow AS/400 users to access NetWare file systems, and send printing to NetWare-managed printers.

Enhanced Integration for NetWare:

- Simplifies network administration with user profile and password propagation. AS/400 group or user profiles and associated information are distributed to multiple NetWare Directory Services (NDS) trees and NetWare 3.12 bindery services. When AS/400 users change their passwords, the change is sent to the NetWare network.
- Simplifies network operations by allowing you to manage NetWare user connections and disk volumes from an AS/400 system.
- Keeps your network secure by authenticating each AS/400 user in NDS or the NetWare 3.12 bindery.
- Gives AS/400 users access to network data. Integrated file system support allows AS/400 users and applications to access files and directories in multiple NDS trees or NetWare 3.12 servers.
- Provides backup support of individual files, directories, and volumes using the Integrated File System directory /QNetWare.

- Gives AS/400 users access to network printers. Print files are sent from an AS/400 output queue to a printer queue managed by the NetWare server.
- Provides integration services through a NetWare Loadable Module (NLM) that runs on all NetWare 3.12 and 4.1 servers, whether or not you have an Integrated PC Server installed on the AS/400 system.
- Two NLMs are provided: one for NetWare 3.12 servers, the other for NetWare 4.1 servers.
- Connects to the AS/400 system using Internet Packet Exchange (IPX) using token-ring, Ethernet, X.25, or frame relay.

1.5 Integration Services for FSIOP

Integration Services for FSIOP is a feature of OS/400 that provides the OS/2 WARP operating system for the Integrated PC Server. It allows you to install an Integrated PC Server in a system for use as a token-ring or Ethernet adapter. This support enables you to run IPX, SNA, and TCP/IP protocols on the adapter to connect two AS/400 systems or to link workstations to the system using Client Access/400. You can also use the adapter as part of your IPX router network. You may want to install this feature without a server or work group application to use the Integrated PC Server as a single or dual-port token-ring or Ethernet adapter.

This feature is required if you are installing NetWare 4.1 on an Integrated PC Server.

1.6 Workstation Clients

Your workstation clients can use OS/2, DOS, Windows, or any other client that is compatible with NetWare 4.1 to access the NetWare server on the Integrated PC Server.

1.7 IPX Support

IBM ships IPX as a part of OS/400. IPX allows the AS/400 system to act as an IPX router.

1.8 Hardware and Software Requirements

The following sections list the hardware and software necessary for installation of OS/400 Integration Products for NetWare.

1.8.1 AS/400 Hardware Requirements

This section lists the hardware requirements if you are installing Integration for NetWare or using Enhanced Integration for NetWare on an Integrated PC Server:

- Models D through F; (except D02, E02, F02); Server Models 100, 135, 140; Advanced Server Models 20S, 30S, 40S, 50S, 53S; Advanced System Models 200, 300, 310, 320, 400, 500, 530; Advanced Entry Model 150
- A CD-ROM device or access to a CD-ROM image
- 32MB or greater Integrated PC Server (optional for Enhanced Integration for NetWare)

You can install up to 16 Integrated PC Servers on each AS/400 system depending on your AS/400 model. You can use an Integrated PC Server that has either one port or two ports. The following tables list the feature numbers of Integrated PC Servers that you can use with OS/400 Integration Products for NetWare.

Table 1. 6506 Feature Order Numbers

Memory	**One-Port Adapter**	**Two-Port Adapter**
32MB	6517	6527
48MB	6518	6528
64MB	6519	6529

Table 2. 6616 Integrated PC Server Feature Order Numbers

Options	**Order Number**
Ethernet/IEEE 802.3 adapter	6181
16/4 Mbps token-ring adapter	6149
32MB memory	2681
128 MB memory	2682

Ordering Example: To order a base 6616 with 32MB of memory to be used with an Ethernet network, you need to specify feature codes 6616, 2681, and 6181. The 6616 does not come with any memory.

Table 3. 2850 Integrated PC Server Feature Order Numbers	
Options	**Order Number**
Ethernet/IEEE 802.3 adapter	2723
16/4 Mbps token-ring adapter	2724
Additional 16MB memory	3861
Additional 32MB memory	2860

Ordering Example: To order a base 2850 with 32MB of additional memory to be used with an Ethernet network, you need to specify feature codes 2850, 2860, and 2723. The 2850 comes with 32MB of memory.

The Integrated PC Server must have a minimum of 100MB disk storage for the system volume. In addition, you also need space for your user data.

Integration Services for FSIOP (57xx-SA2) has additional memory requirements for installing the primary language version of the feature and the network server description.

The Integrated PC Server must be dedicated for use by NetWare 4.1; no other OS/2 products should run on it.

You can install and use Enhanced Integration for NetWare on any V3R7 AS/400 model regardless of whether or not you have an Integrated PC Server installed or if you are running NetWare on an Integrated PC Server.

1.8.2 AS/400 Software Prerequisites

Table 4 (Page 1 of 2). AS/400 Software Prerequisites		
Release	**Integration for NetWare**	**Enhanced Integration for NetWare**
V3R1	5733-SA1 (feature 1643)	
	5733-SA2 (feature 1644)	Not available
	5733-SA3 (feature 1645)	
V3R2	5763-SA2 (feature 1644)	
	5763-SA3 (feature 1645)	Not available
V3R7	5716-SA2 (feature 2244)	5716-SS! option 25 (feature 2246)

Table 4 (Page 2 of 2). AS/400 Software Prerequisites		
Release	**Integration for NetWare**	**Enhanced Integration for NetWare**
	5716-SA3 (feature 2245)	

Enhanced Integration for NetWare, feature 2246, ships two NLMs: one for NetWare 3.12 and one for NetWare 4.1 servers. Order multiple copies of OS/400 feature 2246, depending on the number of servers that you intend to use with Enhanced Integration for NetWare. One license per NetWare server running the NLM is required.

1.8.3 Novell NetWare Server

The following Novell NetWare servers are supported:

- NetWare 3.12 server:

 The NetWare 3.12 server is supported by Enhanced Integration for NetWare only and must be installed on a PC server. NetWare 3.12 cannot be installed on an Integrated PC Server. Integration for NetWare does not support NetWare 3.12 servers.

- NetWare 4.1 server:

 The NetWare 4.1 server (NetWare 4.10 or IntranetWare) can be installed either on a PC server or an Integrated PC Server and is supported by both Integration for Novell NetWare and Enhanced Integration for Novell NetWare features. If you install NetWare 4.1 on an Integrated PC Server, one client workstation attached to an AS/400 system must have the required hardware for a NetWare requester.

Note:

You need a NetWare 4.1 license for every PC server and Integrated PC Server that has NetWare 4.1 installed. OS/400 Integration Products for NetWare do not include the NetWare 4.1 license you need. You can migrate an existing license to the server or purchase a new license.

1.8.4 NetWare Server Hardware Requirements

- CD-ROM drive or access to a CD-ROM image
- If you install NetWare on a PC server, you need one of the following communications adapters for an IPX connection to the AS/400 system:
 - Token-ring
 - Ethernet
 - X.25 (Enhanced Integration for NetWare only)

- Frame Relay (Enhanced Integration for NetWare only)

The server requires at least 2MB memory to run the NLM provided with Enhanced Integration for NetWare.

Chapter 2. IPX Support

This chapter gives an overview of the IPX support on the AS/400 system. Detailed information is found in *AS/400 Internetwork Packet Exchange Support*, SC41-3400.

2.1 IPX Architecture Overview

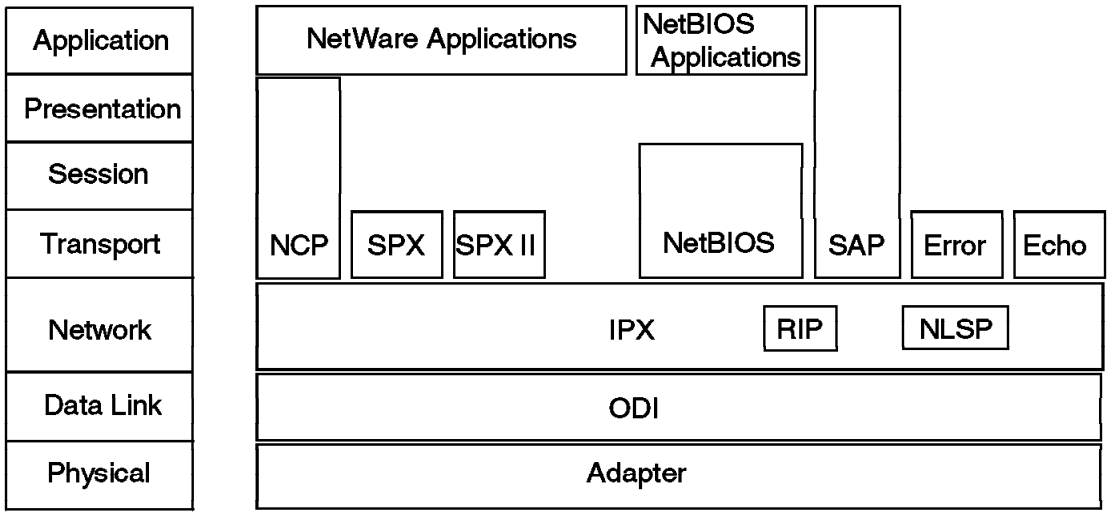


Figure 1. IPX Protocol Stack

IPX is Novell's proprietary network protocol. The focus of IPX is to provide peer-to-peer connectivity in a client/server environment. The same as TCP/IP, IPX is a routable protocol and, hence, can be routed by routers such as an IBM 6611 or 2210. Routable means that the packet header contains all of the information necessary to route packets to their final destination, regardless of whether the destination is on the same LAN or a different LAN.

IPX is the base protocol of Novell NetWare; the other members of the NetWare protocol suite include:

- SPX - Sequenced Packet Exchange
- RIP - Routing Information Protocol
- SAP - Service Advertising Protocol
- NCP - NetWare Core Protocol

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- NLSP - NetWare Link Services Protocol

2.1.1 IPX - Internetwork Packet Exchange

IPX is a connectionless, full duplex protocol. It transmits data to the remote node but does not wait for a response or acknowledgement to indicate that the data has been received successfully. Similar to a mailed letter, each IPX packet goes to its destination with the assumption that it will reach its final destination. It is left to the higher layer protocols to provide guaranteed transmission. Because IPX is connectionless and does not wait for a response, it is able to provide much higher performance than a connection-oriented protocol such as SPX.

The purpose of IPX is to transport higher layer packets to their ultimate destination.

IPX receives packets from a higher level protocol (for example, NCP), encapsulates the packet in an IPX packet, and adds logical addressing. It forwards the packet to the Open Datalink Interface (ODI) layer for hardware addressing.

2.1.2 SPX - Sequenced Packet Exchange

SPX is a connection-oriented protocol built on top of IPX. SPX can be used to guarantee packet delivery and provide error control.

SPXII provides improved performance over SPX. The major advantages of SPXII are:

- The implementation of a windowing algorithm improves SPX packet throughput and reduces the load on the network.
- SPX is limited to a frame size of 576 bytes. SPXII can negotiate much larger frame sizes.
- If a disconnect is received by SPX, it discards any data still in transit. With SPXII, connection partners are able to release the session without any loss of data.

2.1.3 RIP - Routing Information Protocol

Novell's Routing Information Protocol (RIP) is used to broadcast routing information. There can be external routers in addition to the internal NetWare routers within the NetWare servers. Both the internal and the external routers maintain routing tables. These routing tables maintain routing information about all network segments on the NetWare network. The routing tables are kept up-to-date through RIP. All RIP broadcasts are local. RIP broadcasts do not pass through a router to another LAN segment.

2.1.4 SAP - Service Advertising Protocol

The SAP protocol is used to broadcast service provider information. The protocol allows NetWare servers such as file servers and print servers to advertise their services. Each server and router maintains a server information table. This table is kept up-to-date through the SAP broadcasts and contains information about all of the servers in the NetWare network. The same as the RIP broadcasts, all SAP broadcasts are also local. They do not pass through a router to another LAN segment.

2.1.5 NLSP - NetWare Link Services Protocol

NLSP is an improved protocol and replaces the ″noisy″ protocols SAP and RIP. It provides efficient routing with reduced network overhead and better manageability. Broadcast messages are only sent when changes in a link or router occurred.

2.1.6 NCP - NetWare Core Protocol

NetWare Core Protocol is a service protocol running on a NetWare server. It makes server functions such as file services, print services, name management, file locking, and synchronization available to clients. Each available service has a unique number assigned by which it can be acquired.

2.2 IPX Addressing

The IPX address is composed of three elements describing the destination address and three elements describing the source address. These elements of an IPX address are:

- An (internal) network address with four bytes (eight hex digits) uniquely identifies a network in the entire NetWare network.
- The node address with six bytes (12 hex digits) uniquely identifies a node in one (sub-) network.
- The socket number with two bytes (four hex digits) identifies the socket on which the server receives the request.

All devices on the same physical cable section (LAN segment) are considered to be in one network. Bridges and routers connect different networks to build a NetWare network (or Internetwork).

The network address (network number) identifies a network within the NetWare network. Each server and router also has an internal network address. All network addresses (internal and external) must be unique within the NetWare network.

The node address (number) identifies a node (workstation) within an IPX network (LAN segment). The 12-digit hexadecimal number uniquely identifies the adapter card, or in NetWare terms, a network interface card (NIC) in a LAN segment. Either the IEEE assigned ″universal address″ or a locally administered address can be used.

A socket is a hexadecimal four-digit address element of the IPX address. It is used by the IPX layer to identify the higher protocol to which the packet should be passed. Sockets enable multiple, higher layer protocols to use IPX services concurrently. For an IPX client protocol to communicate with its peer partner, it needs to know the socket number of its remote partner application. To ensure the IPX packet travels through the network to the right partner system, the client program also needs to know its partner′s network address and node address. Socket numbers are integer values from X′0001′ to X′FFFF′ (dec 65535).

Socket numbers are either dynamic or static; that means they are either reserved for a special purpose or they are available. Xerox has assigned static sockets to Novell NetWare in the range below X′4000′. For example, SAP has socket number X′0452′ and RIP has X′0453′. Dynamic sockets range from X′4000′ to X′7FFF′. They are used by workstations to communicate with file servers and other network devices. Static sockets are also referred to as ″well-known sockets″. Software developers may reserve available ″well-known sockets″ in the range from X′8000′ to X′FFFF′ through Novell (for example, AnyNet over IPX has socket number X′8796′).

2.3 AS/400 IPX Implementation

The following sections introduce you to the IPX implementation and configuration on the AS/400 system.

IPX on the AS/400 system was originally introduced in V3R1 as a separate program product. In V3R2, it was integrated into OS/400. In V3R6, no IPX support exists. In V3R7, IPX is again implemented as part of OS/400 so there is no special installation procedure for IPX; it is always installed together with OS/400. To activate it, a configuration process is necessary.

Several line protocols are supported by IPX on the AS/400 system.

- Token-ring
- Ethernet
- X.25 (including ISDN adapters)
- Frame Relay

Note

A few things to remember:

1. The AS/400 TR adapter with feature code 2626 does not support IPX.
2. IPX is a native OS/400 protocol; it does not require an Integrated PC Server but it does run over the LAN adapters of the Integrated PC Server.
3. IPX does not run on Integrated PC Servers running LANSERVER/400 or Lotus Notes.

2.3.1 AS/400 IPX Configuration

To configure an IPX configuration on an AS/400 system, the following components are involved:

- IPX description
- Line description
- Circuit description
- Circuit route information
- Circuit service information

The IPX configuration values are stored in configuration files with the exception of the line description, which is a separate object on the AS/400 system.

2.3.2 AS/400 IPX Description

An IPX description defines the characteristics of the local IPX node. There can be multiple IPX descriptions configured, but only one can be active at a time. An IPX description can be compared with the network attributes on the AS/400 system.

Two IPX descriptions are shipped with OS/400; QDCIPX1 and QDCIPX2. Either one can be used as is or can be changed, or a new IPX description can be created/used.

```
                      Create IPX Description (CRTIPXD)

TYPE CHOICES, PRESS ENTER.

IPX description  . . . . . > AS40012       NAME
IPX internal network number  . > 10A10020  1 00000001-FFFFFFFE, *RANDOM
IPX routing protocol . . . . . *NLSP  2 *NLSP, *RIP
IPX router name  . . . . . .   AS40012   3

IPX maximum datagram size  . . .   576           576-65535
IPX packet forwarding  . . . . .   *YES  4 *YES, *NO
IPX hop count  . . . . . .  . . .  64            8-127
SPX maximum sessions . . . . . .   1000          100-9999
SPX watchdog abort timeout . . .   30000         30000-3000000
SPX watchdog verify timeout  . .   3000          556-300000
SPX are you there timeout  . . .   6000          556-600000
SPX default retry count  . . . .   10            1-255
LAN hello  . . . . . .  . . . .    20            1-600
WAN hello  . . . . . .  . . . .    20            1-600
Designated router interval . . .   10            1-100
                                                                    MORE...
F3=EXIT   F4=PROMPT   F5=REFRESH   F12=CANCEL   F13=HOW TO USE THIS DIS
F24=MORE KEYS
```

Figure 2. (Part 1 of 2) Create IPX Description

```
                      Create IPX Description (CRTIPXD)

TYPE CHOICES, PRESS ENTER.

Holding time multiplier  . . . .   3             2-20
Log protocol errors  . . . . . .   *NO           *NO, *YES
Propagate NetBIOS packets          *YES  5          *YES, *NO
SPX2 receive window size           8  6           1 - 16 packets
TEXT 'DESCRIPTION' . . . . . .     IPX Description for AS40012


                          ADDITIONAL PARAMETERS

AUTHORITY  . . . . . . . . . . .   *LIBCRTAUT    NAME, *LIBCRTAUT, *CHANGE...
                                                                    BOTTOM
F3=EXIT   F4=PROMPT   F5=REFRESH   F12=CANCEL   F13=HOW TO USE THIS DISPLAY
F24=MORE KEYS
```

Figure 3. (Part 2 of 2) Create IPX Description

1 The IPX internal network number represents the internal IPX network on this AS/400 system. It controls all services and applications under the IPX and SPX protocol stack. This internal network is accessed and shared by the communications IOPs for IPX and the main processor. An exception is the Integrated PC Server. It has its own internal IPX network and also a separate IPX internal network number. The circuit definitions contain the

numbers of the adjacent IPX networks that can access this internal network. An IPX internal network number has to be unique in the entire Internetwork to guarantee correct datagram delivery.

Note

Clients have **no** internal network number!

2 The IPX routing protocol parameter controls whether RIP/SAP protocols only or NLSP with RIP/SAP compatibility is used for routing. *NLSP means the AS/400 router can interoperate on a network that uses RIP and SAP packets. Use the *RIP value only if there are no NLSP routers in the network.

3 The IPX router name is the symbolic name by which this AS/400 system is known as a router in the network when routing is enabled on this node.

4 IPX packet forwarding enables or disables the router function.

5 This parameter controls if NetBIOS packets generated somewhere in the network should be routed over the IPX network. The AS/400 system does not generate NetBIOS packets but it may route NetBIOS packets generated by a PC over its IPX connections. If you have the requirement to route NetBIOS packets, set this parameter to *YES. This parameter is new for OS/400 V3R7M1.

6 This parameter controls the packet window size for the SPXII support. The default for the parameter is eight. This is the only parameter you have to specify for enabling SPXII. For best performance, especially in a batch environment, set this parameter as high as possible; the maximum value is 16. This parameter is new for OS/400 V3R7M1.

2.3.3 AS/400 Line Descriptions

For IPX support on the AS/400 system, there are no changes in the CRTLINxxx commands. Already configured line descriptions that are used by other protocols (SNA, TCP/IP) can be shared with IPX. You just have to take care of some details.

SSAP considerations for Ethernet and token-ring line descriptions:
SSAP definitions used by IPX support are specified in IPX circuits. The only reason to define SSAPs in the SSAP list of the line description is to allow other protocols (for example, TCP/IP or APPN) to share this line description.

The first time an IPX circuit is started, a controller and a device description of type *NET is created on the line description since they do not exist yet. They are also automatically varied on.

2.3.4 IPX Circuit for LAN

A circuit is a logical representation of a path for IPX communications. For a local area network (LAN), it defines the path or point of attachment from the IPX protocol layer to the IPX network. Circuits are not physical objects. Each circuit is associated with a line description. There must be at least one circuit defined for every line description with which you want to use IPX processing.

```
                          Add IPX Circuit (ADDIPXCCT)

TYPE CHOICES, PRESS ENTER.

Circuit name . . . . . . . . . . > CCTLAN  1
LINE DESCRIPTION . . . . . . . . > TRNLINE  2 NAME
IPX network number . . . . . . . > FFFF0001  3 00000001-FFFFFFFD
Frame type . . . . . . . . . . .   *SSAP  4 *SSAP, *SNAP, *ETHV2, *ETHNTW
Enable for NLSP  . . . . . . . .   *YES  5 *YES, *NO
MAC channel for NLSP . . . . . .   *BROADCAST    *MULTICAST, *BROADCAST
Router priority for NLSP . . . .   64            0-127
Cost override for NLSP . . . . .   *CALC         1-63, *CALC

                            ADDITIONAL PARAMETERS

Default maximum datagram size  .   *LIND         576-16388, *LIND
Throughput . . . . . . . . . . .   *CALC         300-4294967295, *CALC
DELAY TIME . . . . . . . . . . .   *CALC         1-5000000, *CALC
AUTOMATIC START  . . . . . . . .   *YES  6 *YES, *NO
RIP state  . . . . . . . . . . .   *AUTO  7 *ON, *OFF, *AUTO
                                                                    MORE...
F3=EXIT   F4=PROMPT   F5=REFRESH   F12=CANCEL   F13=HOW TO USE THIS DISPLAY
F24=MORE KEYS
```

Figure 4. (Part 1 of 2) Add IPX Circuit for LAN

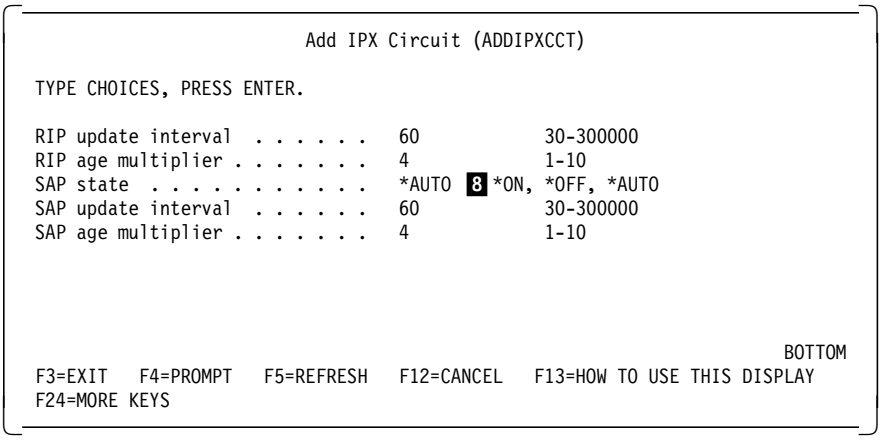


Figure 5. (Part 2 of 2) Add IPX Circuit for LAN

This is an example for a circuit entry associated with a LAN line description.

1 Circuit name is the name that uniquely identifies this circuit.

2 Line description is the name of the line that is associated with this circuit. For LANs, line descriptions for token-ring or Ethernet (using an Ethernet standard value of 802.3, Version 2, or *ALL) can be specified.

3 The IPX network number identifies the external network number this circuit is connected to in IPX LAN networks. It has to be the same on all nodes in this IPX network. Do not mix it up with the internal IPX network number configured in the IPX Description.

4 Frame type specifies the type of LAN framing that is used by the circuit being added. It is controlled by the SSAP of the line description. All systems/devices communicating in one IPX network must use the same frame type. Multiple IPX networks can run on the same physical LAN by using different frame types.

If the value *SSAP is selected, the X′0E′ SSAP is used for this circuit. For this reason, the value X′0E′ must not be defined in the line description. If the AS/400 system has to be added to an existing IPX LAN, the frame type used on this LAN must be checked.

Note: The IPXNETNBR and the FRAMETYPE parameters are only prompted for if the circuit definition is for a LAN line description, while the PVCLGLCHLI and SVCNETNBR parameters are prompted for if the circuit definition is for an X.25/FR line description.

The following table should help to determine the frame type to use on the AS/400 system.

Table 5. Novell Terminology for OS/400 Frame Type Values

OS/400 Circuit Frame Type	**Novell Frame Type**
Ethernet *SNAP	Ethernet_SNAP
Ethernet *SSAP	Ethernet_802.2
Ethernet *ETHV2	Ethernet_II
Ethernet Standard *ALL *ETHNTW	Ethernet_802.3
Token-ring *SNAP	Token-ring_SNAP
Token-ring *SSAP	Token-ring

5 The Enable for NLSP specifies whether or not this circuit is enabled for NetWare Link Services Protocol (NLSP) processing. If a value of *RIP is specified for the IPX routing protocol (IPXRTGPCL) parameter on the IPX description that is active when this circuit is active, the circuit's ENBNLSP parameter value is not used.

6 Automatic start specifies whether this circuit starts automatically at STRIPX. If *NO is chosen, the circuit has to be started manually by the STRIPXCCT command.

7 RIP state specifies the routing information protocol (RIP) indicator mode of support on this circuit. Setting this parameter determines how RIP packets are processed on this circuit. If you want to minimize RIP packets on this circuit, you can set this parameter's value to *OFF and define static routes associated with the system or systems with which you are networking. To minimize RIP traffic on the entire network, you need to define static routes on all servers and routers in your network. You can define static routes using the Add Circuit Route (ADDCCTRTE) CL command.

8 SAP state specifies the Service Advertising Protocol (SAP) indicator mode of support on this circuit. Setting this parameter determines how SAP packets are processed on this circuit. If you want to minimize SAP packets on this circuit, you can set this parameter's value to *OFF and define static services associated with the system or systems with which you are networking. To minimize SAP traffic in the entire network, you need to define static services on all servers and routers in your network. You can define static services using the Add Circuit Service (ADDCCTSRV) command.

Note: For more detailed information about how RIP/SAP/NLSP is controlled on the AS/400 system, see Table 6 on page 24 and Table 7 on page 24.

2.3.5 IPX Circuit for WAN

A circuit is a logical representation of a path for IPX communications. For a wide area network (WAN), it defines the path from the IPX protocol layer to a remote IPX node or system. Circuits are not physical objects. Each circuit is associated with a line description. There must be at least one circuit defined for every line description with which you want to use IPX processing.

Note: For a WAN, it defines the path from the IPX protocol layer to a remote IPX node or system.

```
                          Add IPX Circuit (ADDIPXCCT)

 TYPE CHOICES, PRESS ENTER.

 Circuit name . . . . . . . . . . > CCTX25  1
 LINE DESCRIPTION . . . . . . . . > X25LINE  2 NAME
 X.25 PVC logical channel id  . .   '   '  3 001-FFF
 X.25 SVC network address . . . .   40040301  3
 X.25 SVC call type . . . . . . .   *DEMAND  4 *DEMAND, *PERM
 X.25 SVC reverse charge  . . . .   *NONE          *NONE, *REQUEST, *ACCEPT...
 X.25 SVC idle circuit timeout  .   60            1-600
 X.25 DEFAULT PACKET SIZE:
   TRANSMIT PACKET SIZE . . . . .   *LIND         *LIND, 64, 128, 256, 512...
   RECEIVE PACKET SIZE  . . . . .   *LIND         *LIND, *TRANSMIT, 64, 128...
 X.25 DEFAULT WINDOW SIZE:
   TRANSMIT WINDOW SIZE . . . . .   *LIND         1-15, *LIND
   RECEIVE WINDOW SIZE  . . . . .   *LIND         1-15, *LIND, *TRANSMIT
 Enable for NLSP  . . . . . . . .   *YES          *YES, *NO
 Cost override for NLSP . . . . .   *CALC         1-63, *CALC

                                                                       BOTTOM
 F3=EXIT   F4=PROMPT   F5=REFRESH   F10=ADDITIONAL PARAMETERS   F12=CANCEL
 F13=HOW TO USE THIS DISPLAY        F24=MORE KEYS
```

Figure 6. Add IPX Circuit for WAN

This example shows a circuit entry associated to a WAN line description.

1 Circuit name is the name that uniquely identifies this circuit.

2 Line description is the name of the line that is associated with this circuit. For WAN, only line descriptions for Frame Relay and X.25 can be used.

3 Either the X.25 PVC logical channel ID or the X.25 SVC network address (that is, the DTE address of the remote system) has to be specified when this circuit is associated with a remote IPX network or node.

4 Specify *DEMAND for the X.25 SVC call type because the line description is only activated when there is data to transfer to the remote system.

2.3.6 Circuit Route and Service Information

OS/400 allows you to define route and service information together with the circuit. This allows you define static routes and static services. RIP, SAP, and NLSP protocols provide information about available routes and services dynamically; to do that, additional line traffic is necessary. This additional line traffic is usually acceptable for high speed LANs so these protocols are used in LANs.

For WAN connections, the use of these protocols might be problematic since they usually have a lower speed so the additional line traffic might lead to congestion. Also, WANs are often charged on a volume or connection duration base so the RIP/SAP/NLSP traffic might increase the connection cost considerably.

Static route and service configurations are, therefore, often used on WANs such as X.25 SVC links.

2.3.6.1 Add Circuit Route Information

A static route is associated with a certain circuit. It shows how to reach a remote node or network through that circuit. A static route also defines attributes needed for routing to that remote IPX node or network.

```
                        Add Circuit Route (ADDCCTRTE)

TYPE CHOICES, PRESS ENTER.

Circuit name . . . . . . . . . . > CCTX25  1
Remote IPX network number  . . . > 1002FF0F  2 00000001-FFFFFFFE
Number of hops . . . . . . . . .   1  3   1-127
Number of ticks  . . . . . . . .   20  4  1-32767
Next hop node address  . . . . .   *NONE         000000000001-FFFFFFFFFFFF...


                                                                      BOTTOM
F3=EXIT   F4=PROMPT   F5=REFRESH   F12=CANCEL   F13=HOW TO USE THIS DISPLAY
F24=MORE KEYS
```

Figure 7. Add an IPX Circuit Route Entry

1 The circuit name specifies the unique name of the circuit for which this static route is being used. The circuit is usually an X.25 on demand type of circuit.

2 The remote IPX network number specifies the remote IPX network number or system that this route connects to. The remote IPX network number is usually the internal IPX network number of the remote server or router.

3 Next hop node is the node address of the adjacent router on this LAN that is able to forward packets to the specified remote IP network address. It is not the node address of the destination system. When the circuit route being added is for a WAN circuit, *NONE is the only value allowed.

4 Number of ticks specifies a relative time value that is needed to reach the destination network. A tick is equal to 1/18th of a second. The maximum value allowed is 32 767 ticks, which equals approximately 30 minutes.

Routing Considerations

If routing is used at all and what type of routing the AS/400 system is using is determined by the following four parameters:

- IPXPKTFWD parameter on the CRTIPXD and CHGIPXD command
- IPXRTGPCL parameter on the Create IPX Description (CRTIPXD) and Change IPX Description (CHGIPXD) command
- ENBNLSP parameter on the Add IPX Circuit (ADDIPXCCT) command and CHGIPXCCT command
- RIPSTATE parameter on the ADDIPXCCT command and CHGIPXCCT command

The values of these parameters must be considered together because they affect each other.

The same considerations that apply to the RIP definitions also apply to the SAP definitions (see the SAPSTATE parameter on the ADDIPXCCT command and CHGIPXCCT command).

The following table shows the rules OS/400 uses to control the IPX routing.

Attention

For the routing protocols, the RIPSTATE parameter must be checked together with the result column of the following table.

Table 6. Controlling IPX Routing on AS/400 System

	IPX Description	IPX CCT Description	Result
1. Case	*NLSP	*NO	*RIP
2. Case	*NLSP	*YES	*NLSP
3. Case	*RIP	Ignored	*RIP

Case 1 and Case 3: See the RIPSTATE value table if RIP is used.

Case 2: See the RIPSTATE value table if RIP is concurrently supported. NLSP is used if the remote system supports NLSP.

Table 7. Results of Different RIPSTATE Values

RIPSTATE Value	Result
RIPSTATE(*ON)	Normal RIP Routing is used. OS/400 advertises routes through RIP. OS/400 serves general RIP requests. OS/400 serves specific RIP requests.
RIPSTATE(*OFF)	RIP routing not supported on this circuit. OS/400 advertises no routes through RIP. OS/400 serves specific RIP requests.
RIPSTATE(*AUTO)	OS/400 advertises no RIP routes unless another router advertises routes through RIP. This option allows OS/400 to concurrently support RIP and NLSP routing protocols over the same circuit.

2.3.6.2 Add Circuit Service Information

A static service defines the type of service (for example, file or print service) that is available on a remote IPX node or network. Each static service is associated with a circuit.

```
                        Add Circuit Service (ADDCCTSRV)

TYPE CHOICES, PRESS ENTER.

Circuit name . . . . . > CCTX25  1
Service name . . . . . > 'FILE SERVER'  2

Service type . . . . . > *FILESVR  3 000-FFFF, *ADVPRTSVR...
Remote IPX network number  . . .   1002C0CC3  4 00000001-FFFFFFFE
Remote IPX node address  . . . .   1  4   000000000001-FFFFFFFFFFFE
Remote socket address  . . . . .   0451  4 0001-FFFF
Number of hops . . . . . .  . .   2             1-127


                                                                    BOTTOM
F3=EXIT   F4=PROMPT   F5=REFRESH   F12=CANCEL   F13=HOW TO USE THIS DISPLAY
F24=MORE KEYS
```

Figure 8. Add an IPX Circuit Service Entry

1 Circuit name is the unique name through which this static service is available.

2 Service name is the name of the service available on the remote system.

3 Service type is a set of values allowed including *FILESRVR and *PRTSRVR.

4 To identify the remote system where this static service can be found, specify:

- Remote IPX network number: the internal network number if it is a NetWare 3.x or 4.x server; the external network number if it is an older NetWare server.
- Remote node address: a value of '000000000001' if it is a NetWare 3.x or 4.x server; the MAC address of the server's adapter if it is an older NetWare server.
- Remote socket address

2.4 IPX Routing: Matching Parameters for IPX

The following figure shows the matching parameters for an IPX configuration. The assumption is that SYSTEM02 and SYSTEM0F should act as IPX routers. The two AS/400 systems are connected through an X.25 SVC link. On the LAN with SYSTEM0F, there is another NetWare file server to which NetWare clients on the SYSTEM02 side should have access to.

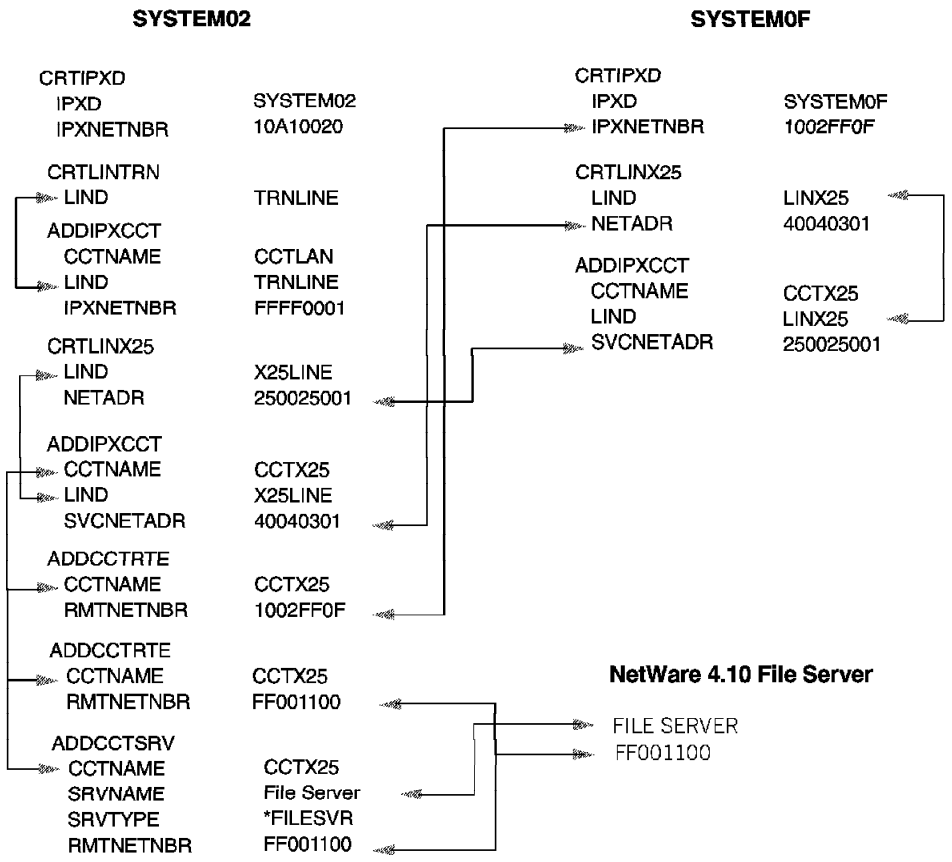


Figure 9. Matching Parameters for an IPX Configuration

2.5 Operating IPX

The following sections give an overview of how to start, end, and operate IPX.

2.5.1 Starting and Ending IPX Support

A STRIPX command must be issued before any IPX processing can be performed on the AS/400 system. The Start IPX (STRIPX) command initializes and activates IPX processing, starts the IPX circuits processing, and starts the IPX circuits that have set the AUTOSTART value of *YES. Only one IPX description can be active at a time. To use a different IPX description, an ENDIPX and another STRIPX defining the IPX description is necessary.

When the STRIPX command is issued, the QIPX job in the QSYSWRK subsystem is started. The QIPX job is used for activating and deactivating IPX circuits and activating and deactivating the IPX support. Also, if the Allow ANYNET (ALWANYNET) support network attribute is set to *YES along with STRIPX, the IP over IPX support is activated. The QAPPCIPX job activates SNA over IPX location name mapping.

Note

We recommend including the STRIPX command in the Start Up program that is run by the QSTRUPPGM system value.

The End IPX (ENDIPX) command ends IPX processing. There are no parameters for this command. The ENDIPX command must be used carefully. There is no confirmation display shown when ENDIPX is entered. When it is used, it ends all IPX processing on the AS/400 system that you are working on. All IPX connections and all IPX circuits are ended. This affects all currently active applications using sockets over IPX. No new open operations are allowed to IPX or SPX sockets. Partially updated data may result if an application is processing data and has not completed an operation when the ENDIPX command is issued. We suggest that you use the following steps:

- Notify all users before issuing the ENDIPX command so that they can end their applications.
- Issue the ENDIPX command at a time when you know no IPX traffic is occurring on the AS/400 system. To display the current IPX activity on the AS/400 system, enter the Work with IPX Status (WRKIPXSTS) command using an OPTION value of *CNN.

2.5.2 WRKIPXSTS - Work with IPX Status

With WRKIPXSTS, you can get information about the status of circuits, routes, services, and connections on the local system. It allows you to also display the active IPX description.

```
                          WORK WITH IPX STATUS
                                                          System:   SYSNM755
Select one of the following:

     1. Work with IPX circuit status
     2. Display IPX route information
     3. Display IPX service information
     4. Work with IPX/SPX connection status
     5. Display active IPX description




Selection or command
===>

F3=Exit   F4=Prompt   F9=Retrieve   F12=Cancel
```

Figure 10. Work With IPX Status (WRKIPXSTS)

2.5.3 Display IPX Service Information

For the OS/400 Enhanced Integration for Novell NetWare, the Display IPX Service Information option is of special interest.

```
                      Display IPX Service Information
                                                          System:   SYSTEM02
 Type options, press Enter.
   5=Display details

       Service              Service        Remote      Hops to    Service
 Opt   name                 Type           Network     Service    Source
       A960502A             *FILESVR       1002CC04        1      *SAP
       AAATLH05             *FILESVR       C050FEED        2      *SAP
       ASSC4                *FILESVR       0406892B        2      *SAP
       A960502A             0107           1002CC04        1      *SAP
       AAATLH05             0107           C050FEED        2      *SAP
       BNSPNC4              0107           663D93C5        2      *SAP
       RCHN2PCE             039B           429F2001        2      *SAP
       !LEX00200005C093     03D6           429F2001        2      *SAP
       PS-IBM4039LAB        03D6           429F2001        2      *SAP
       !LEX031223           03D7           429F2001        2      *SAP
       !LEX05388B           03D7           429F2001        2      *SAP
       A960502A             *NTWENHINTG    1002CC04        1      *SAP
       ASSC4                *NTWENHINTG    0406892B        2      *SAP
                                                                     Bottom
F3=Exit   F5=Refresh   F6=Print list   F12=Cancel   F17=Top   F18=Bottom
```

Figure 11. Display IPX Service Information

Option 3 on the Work with IPX Status menu shows the type of the service available on the remote system. The service type is a 2-byte hexadecimal

value. These hexadecimal values are used by IPX and SPX to identify the NetWare applications or NLMs running on the servers.

Some of these hex values are translated to a readable form on this display. For example, the service type number X/0004 has been translated to *FILESVR.

The service for the OS/400 Enhanced NetWare Integration NLM running on a NetWare server is translated to *NTWENHINTG. The hexadecimal number for this NLM is X/08B0.

Note

This is a good way to verify whether the AS/400 NetWare Enhanced Integration feature NLM is active on a NetWare server in the network.

2.6 Additional Considerations

Some additional considerations are necessary when IPX is to be run on an AS/400 system where Novell NetWare runs on the Integrated PC Server. In this case, the AS/400 system and the NetWare Integrated PC Server are considered as two separate nodes in the IPX network. The internal bus connecting the AS/400 CPU with the Integrated PC Server is considered as a special kind of LAN connection between the AS/400 CPU and the Integrated PC Server. Since, as we already learned, each server/router in an IPX network has its own internal network number, the AS/400 system and the Integrated PC Server each get their own internal network number. The internal network number for the AS/400 system is defined in the IPXNETNBR parameter of the IPX description. The internal network number for the NetWare Integrated PC Server is prompted for with the IPXNETNBR parameter of the INSNTWSVR command.

The result is that possibly two or more IPX descriptions are in use on the AS/400 system at the same time if NetWare is run on an Integrated PC Server of the AS/400 system:

1. One IPX description defines the Integrated PC Server. This description is created when the INSNTWSVR command is run. One IPX description exists on the AS/400 system for every Integrated PC Server running NetWare.
2. Another IPX description defines the AS/400 system. This description is created using the CRTIPXD command of OS/400. Only one description defining the AS/400 system as an IPX node can be active at a time on an

AS/400 system. This kind of IPX description is only necessary under one of the following conditions:

- The AS/400 system serves as a router (for example, LAN-WAN).
- The NetWare Enhanced Integration Feature is run on the AS/400 system.

Note: Remember that these two IPX descriptions refer to two separate nodes in the IPX network.

Chapter 3. Novell NetWare Directory Services

Although this document deals with the integration of Novell NetWare with OS/400 and not with the functions and components of NetWare, an overview over the NetWare Directory Services (NDS) is given here because it is the central point of Novell NetWare 4.1x. For more information about NDS, see the Novell NetWare documentation.

3.1 Why Directory Services?

More and more users feel the need to have and use network-wide directory services to help them to locate services, applications, or components in the network. Since the directory contains resources of the entire network, it should be a distributed directory servicing the entire network, but providing fast information retrieval in that part of the network where it is needed most often. This can only be accomplished through a distributed directory service.

NDS from Novell provides exactly this by maintaining a network-wide directory that is distributed over many servers in the network.

3.2 NetWare Directory Services

NDS is an object-oriented directory services that allows the implementer to create a complete image of the company′s organization. The data in the NDS can be accessed from anywhere in the network independent of where the data is located.

NDS has several advantages:

- Simple administration - NDS, spanning the entire network, can still be maintained and administered from a single point of administration.
- Security - Login authentication, encryption, and access control lists form the main elements of the NDS security.
- Reliability - the NDS data is replicated on several servers in the network, thus providing protection against the loss of a server.
- Flexibility - the hierarchical design of NDS allows for alterations of the NDS structure. Objects can be easily moved from one part of the NDS to another.

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3.3 NDS Tree

NDS uses a hierarchical tree structure. It is consistent with the international standard X.500 developed by IEEE. X.500 defines a method for organizing information in a way so that it can be accessed from the entire network. Novell uses its NDS to provide network-wide information about resources, services, organizational structure, users, and so on. NDS stores this information in objects; the objects are organized hierarchically in a tree, thus forming the directory tree. The NDS tree consists of different types of objects.

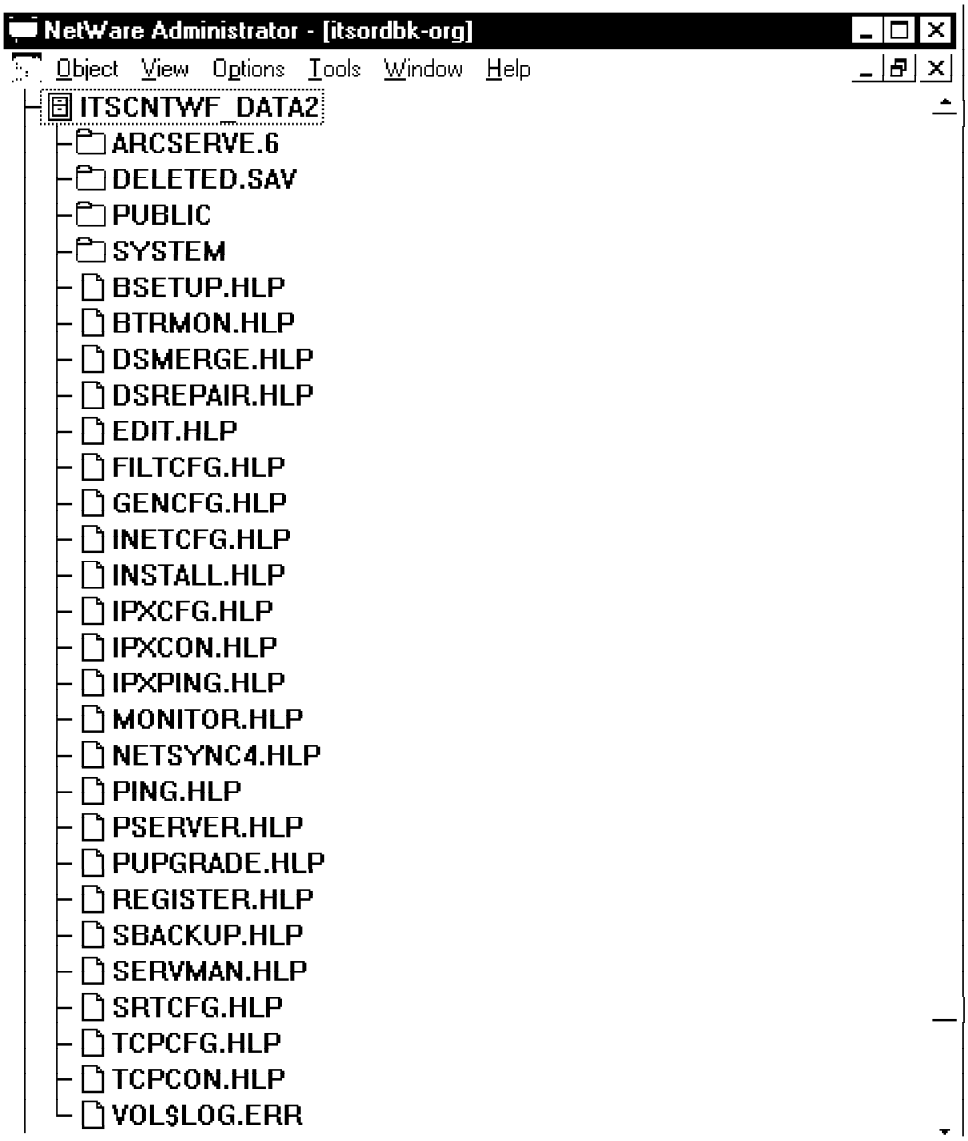


Figure 12. Example of a NetWare Directory Service Tree

3.3.1 Root Object

The root object represents the directory tree itself and its name. It forms the top of the entire directory tree; all other objects are created under it. The root object is created automatically when NetWare 4.1x is installed. It

cannot be renamed or deleted. The administrator can use the NetWare administrator function (NWADMIN) to work on the directory tree. The user ADMIN automatically has the supervisor rights to the root object. This automatically gives this user the rights to all other objects in the tree since the rights are inherited from the object above.

3.3.2 Container Objects

Container objects contain other objects. They are used to group objects in the directory tree logically. This is analogous to directories in a file system, which groups logically-related files together.

NDS supports four different kinds of container objects:

- Country (C) - the country object comes (if it is defined) always directly under the root object. It defines where the objects in the directory services are located. This object is optional in NDS and is not automatically prompted for when installing a directory tree.

 A country object is normally only created when NDS is defined in a multinational company.

 The name of a country object must be two characters long; the countries are defined using the ISO standard abbreviations for the countries.

- Locality (L) - the locality object defines where this portion of the network resides geographically. The locality object is optional in NDS.

 Locality objects can come under the root object, the country object, the organization object, and the organizational unit object. They themselves can contain organization objects and organizational unit objects.

- Organization (O) - the organization object defines an entire organization in a network. The organization object can refer to a company, a department, and so on.

 The organization object is mandatory in NDS. At least one organization object must be defined when defining the directory tree.

 Organization objects must be placed directly under the root object, unless you use locality and country objects. Locality and country objects can come between the root object and the organization object.

- Organizational Unit (OU) - the organizational unit object further defines the organizational structure of your company as it is mapped in the directory tree. It allows you to logically group resources used in a specific part of your company's organization.

The organizational unit object is optional in NDS. If used, it must be defined directly under an organization object, a locality object, or another organizational unit object.

3.3.3 Leaf Objects

Leaf objects are objects that do not contain any other objects. They represent the actual resources in your network such as users, printers, servers, and so on.

Leaf objects are created within container objects. Examples of leaf objects you can create are:

- NetWare Server
- User
- User Group
- Computer
- Print Server
- Printer
- Print Queue
- Volume

3.4 Naming Conventions

Since the objects are in different positions in the directory tree, the objects are defined using distinguished names. The location of an object in the directory tree is called a name context. This is also important for a user logging in. Since the user is defined in a specific location in the directory tree, the user automatically logs in to a specific context. Object names can then be defined in relation to that name context; they do not have to be defined in relation to the root object.

3.4.1 Distinguished Name

The distinguished name of an object is defined as the path from the object to the root of the directory; this path name is the context the object resides in.

Distinguished names must be unique in the directory tree. Also, container names and object names must be unique within that container. Common names must be unique within the container.

3.4.2 Relative Distinguished Name

The relative distinguished name of an object defines the path (context) from the object to another object in the directory tree.

3.4.3 Common Names

Leaf objects in the directory tree have common names (CN); the common name of a user object, for example, is the login name of the user.

Only leaf objects have common names.

3.4.4 Name Types

Object names can be defined in two different ways: as typed (or type-full) names or as non-typed (or type-less) names.

When you use the type-less version of the distinguished name, the elements of the name simply consist of the object names from the object you want to address up the tree to the root. An example is:

```
STORK.AS400.FSC.IBM.DE
```

This distinguished name defines the user Stork in the NDS.

The same name defined in the type-full form is:

```
CN=STORK.OU=AS400.OU=FSC.O=IBM.C=DE
```

CN is the common name of the leaf object, OU refers to the container objects organizational unit, O refers to the container object organization, and C refers to the container object country.

Type-full names are more meaningful for humans since they define, in addition to the object name, the object type the specific object belongs to; they are, however, normally not needed. Type-less names are sufficient for NetWare.

3.5 Object Properties

The properties of an object define the information about the object. The properties of a user object, for example, define the login name, the password restrictions, group membership, and so on.

Properties can be mandatory or optional, depending on the object definition.

Differentiate between the properties of an object and the values of the property. A property of the user object, for example, is the login name; the value of this property can be MEYER. Often more than one value can be defined for one property (for example, several telephone numbers for a user).

NetWare administrator tools allow you to search the NDS for certain property values (for example, the administrator can search for objects with telephone numbers starting with the same city code).

3.6 NDS Security

NDS provides extensive security mechanisms to prevent unauthorized access to the components in the network. Some of the components/terms are explained in the following paragraph.

3.6.1 Object Rights

The term object right refers to what a user can do with the object itself. Object rights control how the object itself can be accessed; they do not control how the information within the object is accessed. A user accessing an object is called a trustee and can have specific rights to the object:

- Supervisor - all rights to the object
- Browse - the right to see the object in the directory tree. This does not mean that the user has the right to browse through the information in the object.
- Create - the right to create objects within a container object
- Delete - the right to delete an object from the directory tree
- Rename - the right to rename an object in the directory tree

3.6.2 Property Rights

While object rights refer to the object itself, property rights relate to the properties of an object and the information stored there.

To access the information in the objects properties, you need the corresponding property rights.

A trustee can have the following property rights:

- Add/Delete Self - the right to add/delete yourself as a value of the property
- Compare - the right to compare a value to existing property values
- Read - the right to read the values of a property
- Supervisor - all rights to the property
- Write - the right to add, change or remove any values of the property

3.6.3 Inherited Rights

As already mentioned, NDS is an object-oriented directory service. Part of that object orientation is the inheritance. An object can inherit the rights granted to its parent object. A trustee can, therefore, inherit the rights to all the objects below the object in the directory tree. Inherited rights filters can be defined to prevent this from happening.

3.6.4 Effective Rights

The effective rights are the result of combining inherited rights, trustee rights, and rights derived from the ″Security Equal to″ property of a user object. The effective rights an object has controls its access to other objects and its properties in the directory tree.

Part 2. Setting Up NetWare on an AS/400 Integrated PC Server

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Chapter 4. Installing Novell NetWare on the AS/400 CISC Platform

The OS/400 Integration for Novell NetWare LPP in V3R1 and V3R2 allows for installing and running Novell NetWare on an Integrated PC Server (IPCS) within your AS/400 system.

As you know, there are no CD-ROM devices on CISC-based AS/400 systems. Since NetWare 4.10 and 4.11 ship on CD-ROM media, a client PC′s CD-ROM drive is used to copy the NetWare server code to the AS/400 storage space.

4.1 Preparing for the Installation

You need to collect some information about your networking environment before starting the installation process to have a smooth and successful installation.

1. Check your Integrated PC Server:

 First, your Integrated PC Server must have at least 32MB of memory installed. However, to improve performance, we recommend using 48MB or more.

2. Check your NetWare software and licenses:

 Since neither the NetWare code nor NetWare licenses are shipped with the AS/400 Licensed Program Products (LPPs), you need to acquire the NetWare CD-ROM and an appropriate amount of NetWare user licenses through the Novell marketing channel.

3. Check the Licensed Program Products on the AS/400 system:

 Verify that the 5763-SA2 LPP and 5763-SA3 LPP have been installed on your AS/400 system.

 Type GO LICPGM on an AS/400 command line and select option 10 to display the installed licensed programs shown in Figure 13 on page 42.

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```
               Display Installed Licensed Programs
                                                    System:   SYSTEM02
Licensed  Installed
Program   Status       Description
5763RG1   *COMPATIBLE  Integrated Language Environment RPG/400
5763RG1   *COMPATIBLE  ILE RPG/400 - S/36-compatible RPG II
5763RG1   *COMPATIBLE  ILE RPG/400 - S/38 environment RPG III
5763RG1   *COMPATIBLE  ILE RPG/400 - RPG/400
5763RG1   *COMPATIBLE  ILE RPG/400 - *PRV ILE RPG/400
5763SA2   *COMPATIBLE  Integration Services for FSIOP
5763SA3   *COMPATIBLE  OS/400 Integration for Novell NetWare
5763SM1   *COMPATIBLE  System Manager/400
5763ST1   *COMPATIBLE  DB2 Query Mgr and SQL Kit for OS/400
5763SV2   *COMPATIBLE  ADSTAR Distributed Storage Manager
5763TC1   *COMPATIBLE  TCP/IP Connectivity Utilities for AS/400
5763WP1   *COMPATIBLE  OfficeVision for OS/400
5763WP1   *COMPATIBLE  OfficeVision for OS/400 - Text Search
                                                              More...
Press Enter to continue.

F3=Exit   F11=Display release   F12=Cancel
```

Figure 13. Display Installed Licensed Programs

If these two licensed programs (5763-SA2 and 5763-SA3) have not already been installed, use option 11 of the LICPGM menu or the OS/400 RSTLICPGM command to install them. After the installation has been performed, apply the latest cumulative PTF package on the AS/400 system.

4. You need one PC attached to the LAN and equipped with the following to run the workstation part of the installation:
 - IBM PC DOS 6.1 or later, or MS DOS 6.2 or later
 - Microsoft Windows 3.1 or 3.11:

 Windows NT and Windows for Workgroups are not supported.

 - NetWare requester 1.21 or later installed:

 The requester provides the ODI communications that are needed for the workstation to communicate with the NetWare server. NDIS configurations are not supported by the INSTALL utility.

 - A CD-ROM drive

4.2 The Installation Process

Running NetWare on an Integrated PC Server using the AS/400 CISC platform is supported under OS/400 V3R1 or OS/400 V3R2. The installation process for the CISC platform basically consists of the following steps:

1. Run the OS/400 INSNTWSVR command:

This command performs the following tasks:

- Creates a network server storage space to hold the NetWare SYS: volume.
- Creates a line description for the Integrated PC Server port you specify.
- Creates an IPX description.
- Adds an IPX circuit for the Integrated PC Server port you specify.
- Links the network server storage space to the network server description.
- Varies on the network server description if *YES was specified for the Vary configuration (VRYCFG) parameter.

2. Install the Workstation Installation feature on the client PC:
 - A Windows program group is created that holds icons for the continuation of the installation process.
 - The Client PC is prepared to run a NetBIOS connection to the AS/400 system to copy the NetWare code from the NetWare CD-ROM to the AS/400 system.

 Therefore, the CONFIG.SYS and AUTOEXEC.BAT files are modified temporarily for establishing a NetBIOS connection to the OS/2 WARP software layer of the Integrated PC Server. To activate the changes, it is necessary to re-boot the Client PC. The installation program will remove the changes to the configuration files after the installation process has completed.
3. After re-booting the Client PC, the next step of the workstation-based installation is performed:
 - A virtual disk drive is created using the Integrated PC Server to connect to AS/400 DASD.
 - NetWare code is copied to AS/400 DASD, representing the NetWare F: drive.
 - The AS/400 NWSD is varied off, then varied on again, and the NetWare server base files are copied from the F: drive to the network server storage space that holds the future NetWare SYS: volume.
4. Use the NetWare Remote Console feature to attach to the newly created NetWare server to finalize the installation, that is:
 - Install the required NetWare licenses for the server.
 - Install the NetWare Directory Services files on the server.

- Finish the installation by copying the remaining NetWare server code to the AS/400 system.

5. Use the NetWare Administration program, NWADMIN, to set up the entries within the NetWare Directory Services (NDS) according to your needs.

4.3 Before You Run INSNTWSVR

There are some parameters you need to know about or decide on before you use INSNTWSVR to run the installation successfully.

- **Resource name (RSRCNAME):**

 You can get the resource name of the Integrated PC Server by using the WRKHDWRSC *CMN command.

```
                Work with Communication Resources
                                                    System:   SYSTEM02
Type options, press Enter.
  5=Work with configuration descriptions   7=Display resource detail
Opt  Resource         Type  Status               Text
_    CMB01            918B  Operational          Combined function IOP
_      LIN01          2609  Operational          Comm Adapter
_        CMN01        2609  Operational          V.24 Port Enhanced
_        CMN02        2609  Operational          V.24 Port
_    CC02             2626  Operational          Comm Processor
_      LIN04          2626  Operational          LAN Adapter
_        CMN05        2626  Operational          Token-Ring Port
_    CC01             6506  Operational          File Server IOP
_      LIN05          6520  Operational          LAN Adapter
_        CMN06        6520  Operational          Token-Ring Port
_      LIN06          6520  Operational          LAN Adapter
_        CMN07        6520  Operational          Token-Ring Port
_      LIN03          6B00  Operational          Virtual Adapter
_        CMN04        6B00  Operational          Virtual Port
                                                         More...
F3=Exit   F5=Refresh   F6=Print   F12=Cancel
```

Figure 14. CC01 is the Resource Name for Integrated PC Server

- Port information:

 1. **Port number:**

 If you have a two-port Integrated PC Server, decide which port to use to install NetWare.

 2. **Line type:**

 You can select one of the following three options that is related to your LAN type:
 - ***ETH,** for Ethernet

- ***TRN4M,** for token-ring with a ring speed of 4MB
- ***TRN16M,** for token-ring with a ring speed of 16MB

3. **Local adapter address:**

 Specifies the LAN adapter address to use. When line type *ETH is specified, the adapter address must be in the range of 020000000000 to 7EFFFFFFFFFF. For *TRN4M and *TRN16M, the adapter address must be in the range of 400000000000 to 7FFFFFFFFFFF.

4. **IPX network number:**

 The IPX network number is often called the IPX external network number or the IPX network address. All NetWare servers that have to communicate with each other must use the same IPX external network number. If you start your own network with the installation of the Integrated PC Server, you are free to create your own external IPX number. If you have to integrate your new network server IPX into an existing IPX network, you must use the IPX external network number specifying this network. You can find the existing number using the NetWare Remote Console utility and issuing the **CONFIG** command.

```
File server name: ITSONTWS
IPX internal network number: 33231CC3
     Node address: 000000000001
     Frame type: VIRTUAL_LAN
     LAN protocol: IPX network 33231CC3
Server Up Time:  3 Days 1 Hour 25 Minutes 22 Seconds

IBM Token-Ring Shared RAM
     Version 3.29    August 14, 1995
     Hardware setting: I/O ports 300h to 303h, Memory DC000h to DCFFFh and DD000
h to DDFFFh,
                       Interrupt 9h
     Node address: 0004ACB7036C
     Frame type: TOKEN-RING
     Board name: TOKEN_1_TOK
     LAN protocol: IPX network 444F2222

IBM Token-Ring Shared RAM
     Version 3.29    August 14, 1995
     Hardware setting: I/O ports 300h to 303h, Memory DC000h to DCFFFh and DD000
h to DDFFFh,
                       Interrupt 9h
     Node address: 0004ACB7036C
     Frame type: TOKEN-RING_SNAP
<Press ESC to terminate or any other key to continue>
```

Figure 15. The CONFIG Command: IPX Network Number is 444F2222

5. **Frame type:** There are four frame types you can select:

***SSAP**:

*SSAP indicates that the Source Service Access Point (SSAP) uses the ′E0′X SSAP for the IPX circuit. Specifying *SSAP is equivalent to the 802.2 frame type. This frame type can be specified for *ETH, *TRN4M, and *TRN16M line types.

***SNAP**:

*SNAP indicates that the Sub-Network Access Protocol (SNAP) uses the ′AA′ SSAP for the IPX circuit. To run NetWare TCP/IP with source routing bridges, *SNAP frame type must be specified so an IPX circuit with the *SNAP frame type is associated with the line description.

***ETHV2**:

*ETHV2 indicates the IPX circuit is running on Ethernet Version II. No SSAP is used for this IPX circuit. This frame type can only be specified for line types of *ETH. *ETHV2 frame type is only valid for Ethernet Version 2 lines or an Ethernet line description using an Ethernet standard value of *ALL.

***ETHNTW**:

*ETHNTW indicates the IPX circuit is running on a Novell NetWare 802.3 Ethernet standard. No SSAP is used for this IPX circuit. This frame type can only be specified for a line type of *ETH.

- **Copy NetWare source (CPYNTWSRC):**

 If this is the first time you install NetWare on the Integrated PC Server, this parameter must be *YES. If you have already installed the NetWare source, this parameter is *NO by default. If you then specify *YES, the AS/400 system copies the source again, overlaying what exists on the Integrated PC Server.

- **Vary on configuration (VRYCFG):**

 If you select *YES, the AS/400 system validates the resource name and varies on the network server description that you just created. If you select *NO, the system neither validates nor varies on the network server.

- **IPX internal network number (IPXNETNBR):**

 This number identifies an individual NetWare server within an IPX network and it must be unique. You can invent a number or let the system generate it for you.

- **Network server storage space (NWSSTG):**

Enter name and size of the network server storage space here. If you specify *NWSD for the name, the server storage space name is the same as the name of the server description.

The size of the network server storage space can be between 100MB and 8000MB. Make sure you specify enough space for the NetWare server, the NetWare Directory Services (NDS), the NetWare Loadable Modules (NLMs), and other software you want to keep on the system volume. Since this storage space is used for the NetWare system volume, we recommend that you store all of your application data in other storage spaces and volumes, which you can create later.

- **FSIOP language version (LNGVER):**

 This parameter points to the language version that is associated with the OS/2 Warp layer of the network server, and does not relate to the language version of NetWare 4.1 to be installed. The default is *PRIMARY, which uses the primary national language of your system. If you are not sure which language version is used as primary, you can use the DSPSFWRSC command.

```
                          Display Software Resources
                                                                System:   SYSTEM12
Resource
   ID     Option  Feature  Description
5716999   *BASE    5050    AS/400 Licensed Internal Code
5716SS1   *BASE    5050    Operating System/400
5716SS1   *BASE    2924    Operating System/400
5716SS1   *BASE    2925    Operating System/400
5716SS1   1        5050    OS/400 - Extended Base Support
5716SS1   1        2924    OS/400 - Extended Base Support
5716SS1   1        2925    OS/400 - Extended Base Support
5716SS1   2        5050    OS/400 - Online Information
5716SS1   2        2924    OS/400 - Online Information
5716SS1   2        2925    OS/400 - Online Information
5716SS1   7        5050    OS/400 - Example Tools Library
5716SS1   7        2924    OS/400 - Example Tools Library
5716SS1   8        5050    OS/400 - AFP Compatibility Fonts
5716SS1   9        5050    OS/400 - *PRV CL Compiler Support
5716SS1   9        2924    OS/400 - *PRV CL Compiler Support
                                                                          More...
Press Enter to continue.

F3=Exit   F11=Display libraries/releases   F12=Cancel
```

Figure 16. The DSPSFWRSC Command

- **NetWare language (NTWLNGID):**

 Specify the NetWare language number and directory associated with the NetWare language you want to use and install from the NetWare

CD-ROM. The NetWare language can be different from the OS/400 language. Table 8 on page 48 is the NetWare language version.

Table 8. NetWare Language Version

Language number	Language
0	French Canadian
1	Simplified Chinese
2	Danish
3	Dutch
4	English
5	Finnish
6	French-France
7	German
8	Italian
9	Japanese
10	Korean
11	Norwegian
12	Portuguese-Brazil
13	Russian
14	Spanish-Latin America
15	Swedish
16	Traditional Chinese
17	Polish
18	Portuguese-Portugal
19	Spanish-Spain
20	Hungarian
21	Czech

- **NetWare source directory (NTWSRCDIR):**

 If you have entered *YES in the Copy NetWare source parameter, you have to specify the source directory for the installation here.

 To find out the name of the volume on a CD-ROM device, enter the following command:

  ```
  DSPOPT VOL(*MOUNTED) DEV(device-name)
  ```

The device name is the CD-ROM device name of the AS/400 system; you can check it with the following command:

```
WRKCFGSTS CFGTYPE(*DEV) CFGD(*OPT)
```

4.4 Run the INSNTWSVR Command

```
                Install NetWare Server (INSNTWSVR)

Type choices, press Enter.

Network server description . . . > ITSCNTWC      Name, *CPYONLY
Resource name  . . . . . . . . . > CC01          Name
Port 1:

  Line type  . . . . . . . . . . > *TRN16M   *ETH, *TRN4M, *TRN16M
  Local adapter address  . . . . > 42000F00F00F 020000000000-7FFFFFFFFF
  IPX circuit information:
  IPX network number . . . . . . > 444F2222  00000001-FFFFFFFD
  Frame type . . . . . . . . . .   *SSAP     *SSAP,*SNAP,*ETHV2,*ETHNTW
              + for more values
Port 2:
  Line type  . . . . . . . . . .             *ETH, *TRN4M, *TRN16M
  Local adapter address  . . . .             020000000000-7FFFFFFFFF
  IPX circuit information:
  IPX network number . . . . . .             00000001-FFFFFFFD
  Frame type . . . . . . . . . .   *SSAP     *SSAP,*SNAP,*ETHV2,*ETHNTW
              + for more values
                                                                  More...
F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys
```

Figure 17. Install NetWare Server (Display 1)

```
                Install NetWare Server (INSNTWSVR)

Type choices, press Enter.

Vary on configuration  . . . . .   *YES      *YES, *NO
IPX internal network number  . .   *RANDOM   00000001-FFFFFFFE, *RAN
Server message queue . . . . . .   *JOBLOG   Name, *JOBLOG, *NONE
  Library  . . . . . . . . . . .             Name, *LIBL, *CURLIB
Network server storage space:
  Name . . . . . . . . . . . . .   *NWSD     Name, *NWSD
  Size . . . . . . . . . . . . .   200       100-8000
Language version . . . . . . . .   *PRIMARY  *PRIMARY, 2963, 2966, 2
Country code . . . . . . . . . .   *LNGVER   *LNGVER, 001, 002, 031,
Code page  . . . . . . . . . . .   *LNGVER   *LNGVER, 437, 850, 852,
Text 'description' . . . . . . .   NetWare server



                                                          Bottom
F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys
```

Figure 18. Install NetWare Server (Display 2)

After running the INSNTWSVR command, the server remains in the *VARY ON PENDING status until the workstation part of the installation is done.

4.5 The Workstation Part of the Installation

First, you need to install code from the OS/400 Integration Installation diskette on your PC, which enables a NetBIOS connection to the AS/400 Integrated PC Server.

After re-booting your PC, the NetWare files are copied to the AS/400 system, the NWSD is automatically varied off and on again. During this process the NetWare SYS: volume is created on the AS/400 system.

4.5.1 Installation Steps

1. Start Windows; insert the diskette labeled **OS/400 Integration for Novell NetWare** in drive A: and run the INSTALL.EXE program.
2. Some files are loaded on the PC, and the NetWare Integration Installation window is brought up as shown in Figure 19 on page 51.

 After this display is shown, a README file appears. After you have clicked on the Continue button, you see the Install-progress window shown in Figure 20 on page 51.

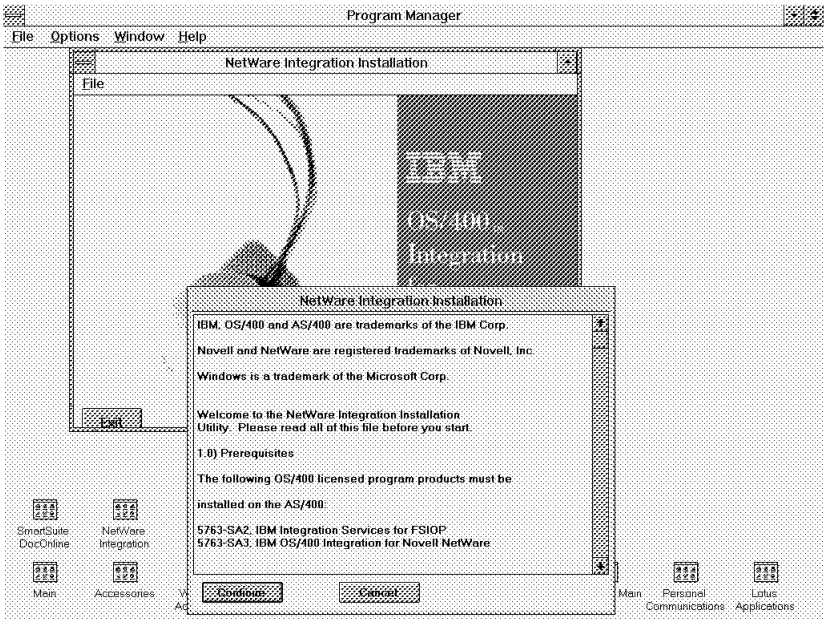


Figure 19. OS/400 Integration for Novell NetWare Installation Window

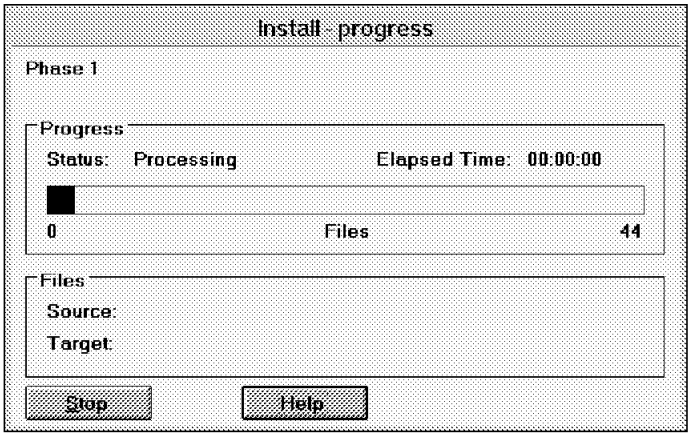


Figure 20. OS/400 Integration for Novell NetWare Install Progress Window

3. On the next window, specify which LAN driver to use on the Client PC:
 - If you are using a token-ring adapter supported by IBM LAN Support Program V1.38, select Token-Ring DXMC0MOD.SYS.
 - If you are using a token-ring adapter or Ethernet adapter with an ODI driver, select Ethernet ODI.

- If you are using an Ethernet adapter, choose Ethernet ODI.
- If you specify **Other Token-Ring driver**, you must specify the path name and required parameters of the driver being used. It is assumed this driver is a direct replacement of DXMC0MOD.SYS and compatible with DXMA0MOD.SYS and DXMT0MOD.SYS.

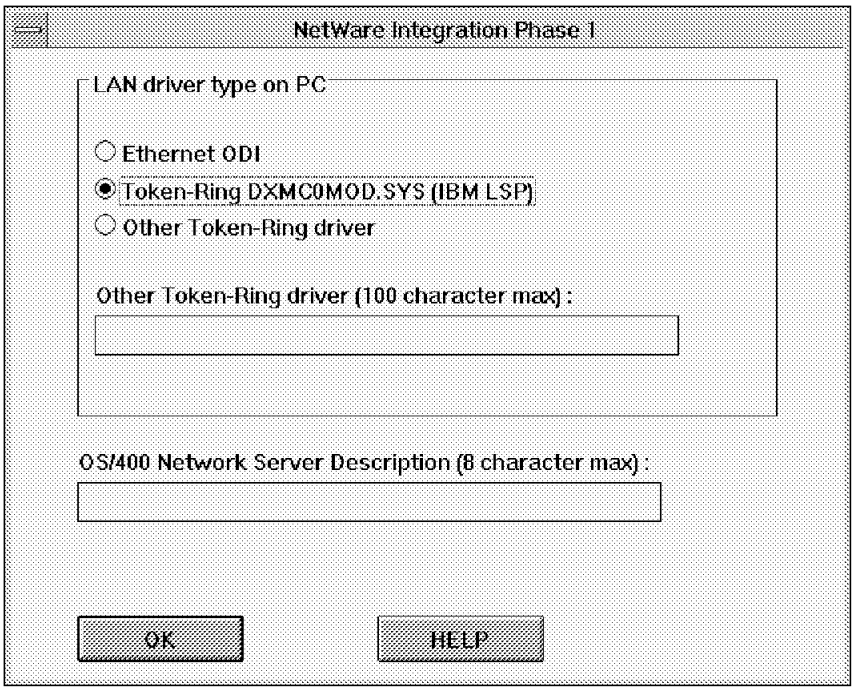


Figure 21. NetWare Integration Phase 1 Window

4. In this window, you also have to specify the network server description that you created when running the INSNTWSVR command in the **OS/400 Network Server Description** field.
5. Click on the OK button. Phase 1 of NetWare Integration installation is completed in a few minutes. Exit Windows and re-boot your PC.
6. After the PC has started again, a NetBIOS connection has been set up between your PC and the AS/400 network server. Now, click on the **Start Phase 2 Install** icon in the NetWare Integration Group (see Figure 22 on page 53).

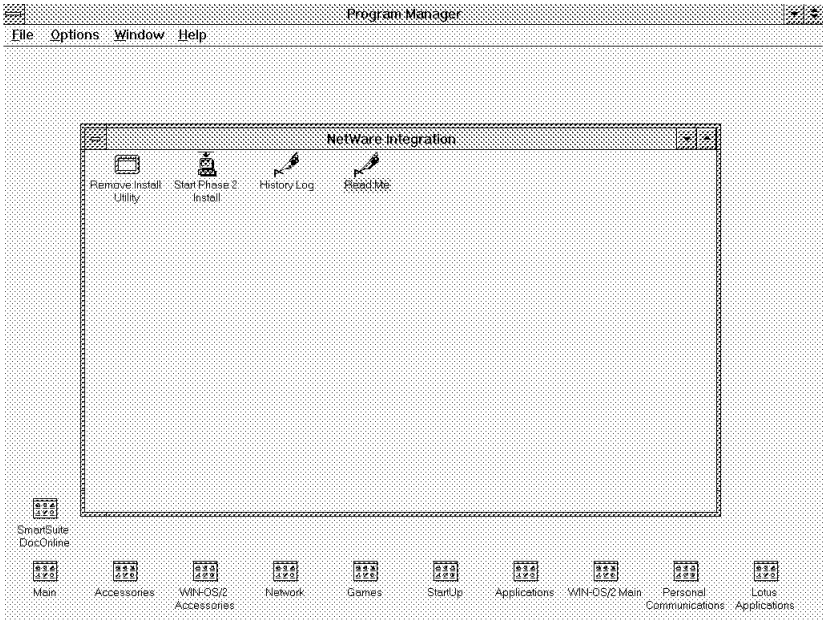


Figure 22. NetWare Integration Group

7. On the next window, click on the Continue button. Then, the **Install-Directories** window is brought up where you can specify components you want to have installed:

 - AS/400 NetWare Server
 - RCONSOLE
 - NWADMIN

 As you select the components you need, the number of bytes needed to install those components on your personal computer are displayed. Since the NetWare Server is installed on the AS/400 system, no space on the workstation is required for that component.

8. After you have clicked on the Install button, you are prompted to select the NetWare language name and the path name of the NetWare files on your installation CD-ROM.

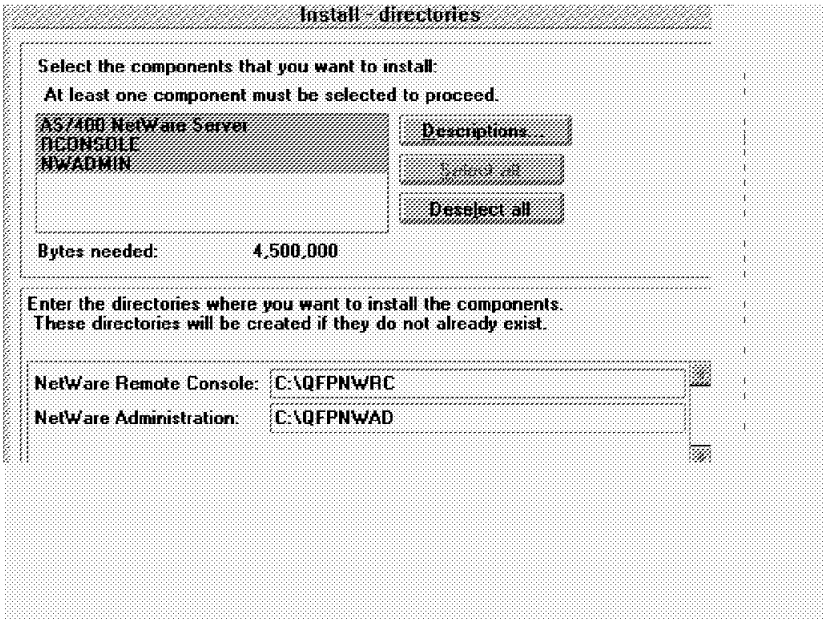


Figure 23. NetWare Installation Phase 2 Window

9. Click on the OK button to start phase 2 of the workstation installation.
10. After the installation is completed, you can exit the NetWare Integration utility on the workstation.
11. On the AS/400 system, the network server description object changes to a status of ACTIVE when the server is up and running. You can use the WRKNWSSTS system command to verify it.

Now you have finished the workstation part of the installation. After this, you also need to install additional NetWare files, Licenses, and the NetWare Directory Services on your Integrated PC Server. The RCONSOLE function is used to perform these steps. Please refer to Section 4.6, “Additional Software to Install” for this information.

4.6 Additional Software to Install

There is additional software such as the NetWare licenses, NetWare Directory Services, and other NetWare files that need to be installed from a PC client. We use two important NetWare tools, the NetWare Remote Console (RCONSOLE) and the NetWare Administrator Utility (NWADMIN) to finish the installation.

4.6.1 The NetWare Remote Console (RCONSOLE) Function

RCONSOLE is a DOS based application that allows you to manage a NetWare server from any PC client and perform tasks such as:

- Issue a NetWare console command.
- Scan directories and edit text files in both NetWare and DOS partitions on a server.
- Transfer files to a server.
- Manage volumes.
- Install licenses, NetWare Directory Services (NDS), and utilities.

We use this tool to install the additional NetWare software on the Integrated PC Server.

4.6.2 Additional Installation Steps

Run the RCONSOLE program on your NetWare requester workstation and select the NetWare server you just installed on the Integrated PC Server. The Remote Console utility requires a password. The default password for RCONSOLE is the name of the network server description for your Integrated PC Server on the AS/400 system. After you have logged onto the server, you might want to change the password for security reasons.

If you cannot find the server in the list of available servers, press the Insert key and specify the internal IPX number of your Integrated PC Server. RCONSOLE searches for the server using this number and comes back with the password request.

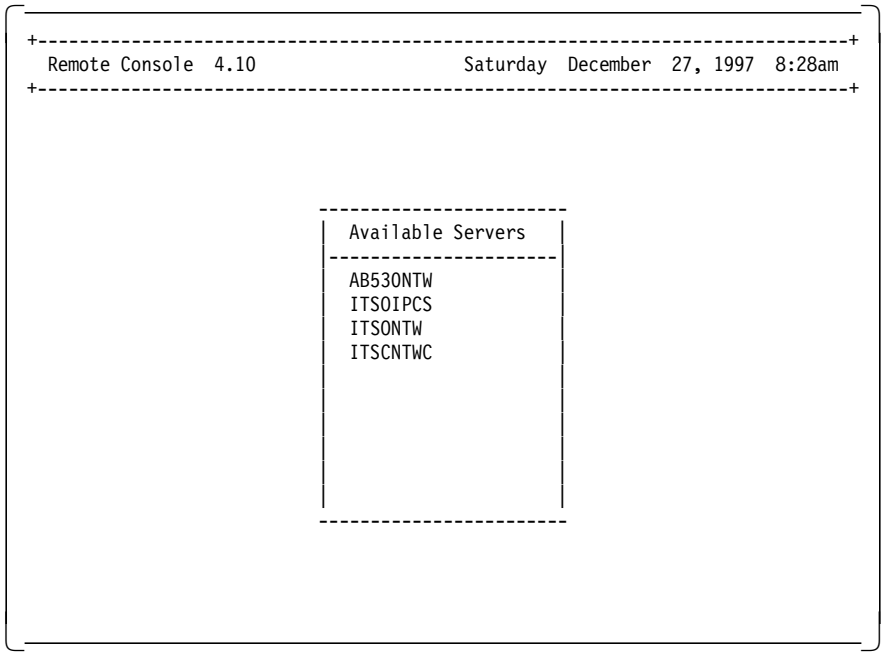


Figure 24. RCONSOLE Server Selection

Once you have entered the password, you see the console window of the new server. Now use the LOAD INSTALL console command to bring up the **Installation Options** menu shown in Figure 25 on page 57.

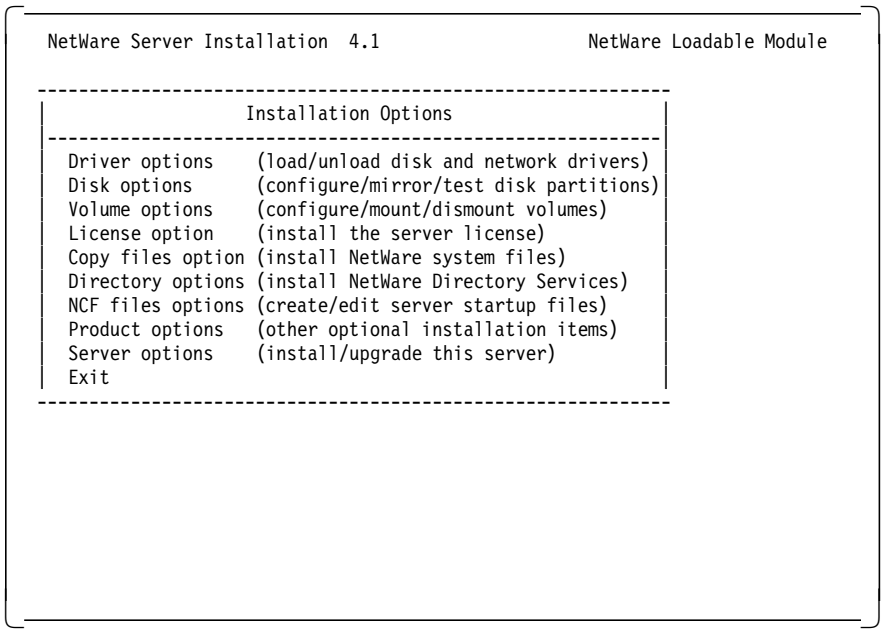


Figure 25. Installation Options Menu

Now perform the following steps:

- From the menu, select **License options** to install the NetWare licenses.

 Press F4 to redirect the installation program to receive input from your local A: drive, insert the license diskette, and press Enter.

- Return to the Installation Options menu and select **Directory options** to install the NetWare Directory Services.

- On the following window, select **Install Directory Services onto this server** shown in Figure 26 on page 58.

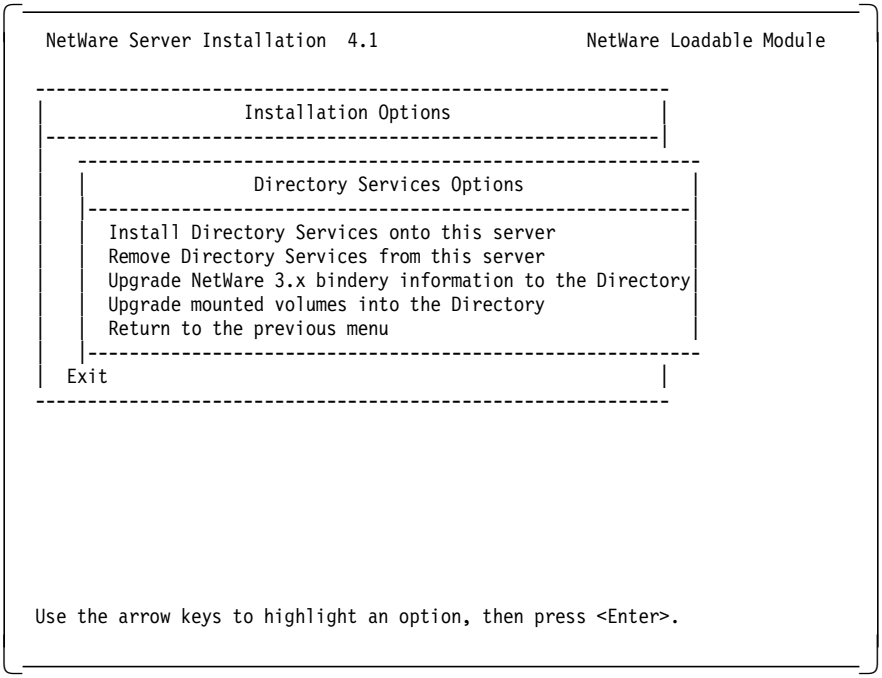


Figure 26. Install Directory Services

You can create a new NDS tree or select one from the list of available trees. If you want to create a new NDS tree, press the Ins key and specify the tree name and time zone. You must specify an **Organization** name here and you may also want to create **Organizational unit** entries.

For more information, please refer to *OS/400 NetWare Integration Support*, SC41-4124.

- Return to the **Installation Options** menu and select **Copy files option** to copy additional NetWare files.

 Insert the NetWare software CD into the CD-ROM drive of your PC and press **F4** to change the path to:

 G:\NW410\INSTALL\ENGLISH

 where G: points to the name of the CD-ROM drive. If you install a different language (or depending on the media you use for the installation), the path name is different from the one we used in the preceding example.

 You also need to specify the **server boot path** that contains the **SERVER.EXE**. For an Integrated PC Server based server, this is the E:

drive of the Integrated PC Server. In the next window, you can specify which files are actually copied to the network server storage space.

You see some warning messages during the copy process due to the fact that some files were already installed when you ran the INSNTWSVR command on the AS/400 system. Ignore these warning messages and continue the process.

- After finishing the copy process, return to a 5250 emulation window and issue the WRKCFGSTS *NWS command shown in Figure 27. Use option 2 to vary off the network server description. **Do not** use the RCONSOLE command DOWN to shut down an Integrated PC Server based NetWare server.

```
                        Work with Configuration Status              SYSTEM12
                                                          03/25/97  17:48:20
Position to  . . . . .               Starting characters

Type options, press Enter.
  1=Vary on   2=Vary off   5=Work with job   8=Work with description
  9=Display mode status ...

Opt  Description       Status                -------------Job--------------
     ITSCNTWC          ACTIVE
       ITSCNTWC01      VARIED ON
       ITSCNTWC02      VARIED ON









                                                                       Bottom
Parameters or command
===>
F3=Exit   F4=Prompt   F12=Cancel   F23=More options   F24=More keys
```

*Figure 27. WRKCFGSTS *NWS*

After the NetWare server has been varied off successfully, use option 1 to vary on the server description.

Chapter 5. Installing Novell NetWare on the AS/400 RISC Platform

OS/400 V3R7 allows for the installation of Novell NetWare on an Integrated PC Server using the built-in CD-ROM drive. Basically the installation consists of two steps:

1. Running the OS/400 Install NetWare Server (INSNTWSVR) command.
2. Using the NetWare Remote Console tool to perform the configuration steps for the new NetWare server and finalize the installation.

5.1 Preparing for the Installation

You need to gather some information about your networking environment before starting the installation process to have a smooth and successful installation.

1. Check your Integrated PC Server:

 First, your Integrated PC Server must have at least 32MB installed. However, to improve performance, we recommend that you use 48MB or more.
2. Check your NetWare software and licenses:

 Since neither the NetWare code nor NetWare licenses are shipped with the AS/400 licensed program products (LPPs), you need to acquire the NetWare CD-ROM and an appropriate amount of NetWare user licenses through the Novell marketing channel.
3. Check the licensed program products on the AS/400 system:

 Verify that the 5716-SA2 LPP and 5716-SA3 LPP have been installed on the AS/400 system.

 - Type GO LICPGM on an AS/400 command line and select option 10 to display the installed licensed programs.

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```
               Display Installed Licensed Programs
                                                    System:   SYSTEM02
Licensed  Installed
Program   Status       Description
5716RD1   *COMPATIBLE  R/DARS Record Archive Feature
5716RG1   *COMPATIBLE  Integrated Language Environment RPG/400
5716RG1   *COMPATIBLE  ILE RPG/400 - S/36-compatible RPG II
5716RG1   *COMPATIBLE  ILE RPG/400 - S/38 environment RPG III
5716RG1   *COMPATIBLE  ILE RPG/400 - RPG/400
5716RG1   *COMPATIBLE  ILE RPG/400 - *PRV ILE RPG/400
5716SA2   *COMPATIBLE  Integration Services for FSIOP
5716SA3   *COMPATIBLE  OS/400 Integration for Novell NetWare
5716SM1   *COMPATIBLE  System Manager/400
5716ST1   *COMPATIBLE  DB2 Query Mgr and SQL DevKit for OS/400
5716SV2   *COMPATIBLE  ADSTAR Distributed Storage Manager
5716TC1   *COMPATIBLE  TCP/IP Connectivity Utilities for AS/400
5716WP1   *COMPATIBLE  OfficeVision for OS/400
5716WP1   *COMPATIBLE  OfficeVision for OS/400 - Text Search
                                                              More...
Press Enter to continue.

F3=Exit   F11=Display release   F12=Cancel
```

Figure 28. Display Installed Licensed Programs

- If these two licensed programs have not already been installed, use the OS/400 Restore Licensed Program (RSTLICPGM) command to install these licensed programs.
- After the installation, it is necessary to apply the latest cumulative PTF package on the AS/400 system.

4. You need a PC equipped with a CD-ROM drive that is capable of running the NetWare client software.

 In our testing, we used both:
 - NetWare 16-bit client under Windows 3.1
 - NetWare 32-bit client under Windows 95

5.2 Installation Process

In V3R7, you can install the NetWare 4.1x base server code directly from the AS/400 integrated CD-ROM drive. This simplifies the installation compared to an installation on an AS/400 CISC platform because there is no need to establish a NETBIOS connection from a client PC to the AS/400 system to get the NetWare base code loaded on the AS/400 system. One single OS/400 command, INSNTWSVR, is used to specify all of the required information for the system to both copy the NetWare base server code to the AS/400 system and perform all AS/400 related configuration tasks for you.

Installation Steps:

1. Run the OS/400 INSNTWSVR command. This command performs the following tasks:

 - Copies the NetWare source image from AS/400 CD-ROM to server storage space.
 - Creates an IPX description.
 - Creates a network server description.
 - Creates a line description.
 - Adds an IPX circuit.
 - Creates a network server storage space for the NetWare SYS: volume.
 - Links the network server storage space to the network server description.
 - Varies on the network server description if *YES was specified for the vary configuration (VRYCFG) parameter.

2. Use the NetWare Remote Console feature to:

 - Install the required NetWare licenses.
 - Perform the NetWare Directory Services (NDS) related tasks.
 - Finish the installation by copying the remaining NetWare server code to the AS/400 system.

5.2.1 Before You Run INSNTWSVR

There are some parameters you need to know about or decide on before you run INSNTWSVR to complete the installation successfully.

- Resource name:

 You can resolve the resource name of the Integrated PC Server by using the Work with Hardware Resources (WRKHDWRSC *CMN) command specified in Figure 29 on page 64.

```
                Work with Communication Resources
                                                        System:   SYSTEM02
Type options, press Enter.
  5=Work with configuration descriptions   7=Display resource detail
Opt  Resource        Type  Status               Text
_    CMB01           918B  Operational          Combined function IOP
_      LIN01         2609  Operational          Comm Adapter
_        CMN01       2609  Operational          V.24 Port Enhanced
_        CMN02       2609  Operational          V.24 Port
_    CC02            2626  Operational          Comm Processor
_      LIN04         2626  Operational          LAN Adapter
_        CMN05       2626  Operational          Token-Ring Port
_    CC01            6506  Operational          File Server IOP
_      LIN05         6520  Operational          LAN Adapter
_        CMN06       6520  Operational          Token-Ring Port
_      LIN06         6520  Operational          LAN Adapter
_        CMN07       6520  Operational          Token-Ring Port
_      LIN03         6B00  Operational          Virtual Adapter
_        CMN04       6B00  Operational          Virtual Port
                                                        More...
F3=Exit   F5=Refresh   F6=Print   F12=Cancel
```

Figure 29. Work with Hardware Resources (CC01 Represents Integrated PC Server)

- Port information:

 1. **Port number:**

 If you have a two-port Integrated PC Server, you have to decide which port to use to connect your server to the network.

 2. **The line type:**

 You can select one of the following three options that is related to your LAN type:

 - ***ETH** for Ethernet
 - ***TRN4M** for token-ring with a ring speed of 4MB
 - ***TRN16M** for token-ring with a ring speed of 16MB

 3. **Local adapter address:**

 Specifies the LAN adapter address to use. When line type *ETH is specified, the adapter address must be in the range of 020000000000 to 7EFFFFFFFFFF. For *TRN4M and *TRN16M, the adapter address must be in the range of 400000000000 to 7FFFFFFFFFFF.

 4. **IPX network number:**

 The IPX network number is often called the IPX external network number or the IPX network address. All NetWare servers that have to communicate with each other have to use the same IPX external network number. If you start your own network with the installation

of the Integrated PC Server, you are free to create your own external IPX number. If you have to integrate the IPX within an existing IPX network, you have to use the IPX external network number specifying this network. You can find the existing number using the NetWare Remote Console utility and issuing the **CONFIG** command shown in Figure 30.

```
File server name:  ITSONTWS
IPX internal network number:  33231CC3
     Node address:  000000000001
     Frame type:  VIRTUAL_LAN
     LAN protocol:  IPX network 33231CC3
Server Up Time:  3 Days 1 Hour 25 Minutes 22 Seconds

IBM Token-Ring Shared RAM
     Version 3.29    August 14, 1995
     Hardware setting: I/O ports 300h to 303h, Memory DC000h to DCFFFh and DD000
h to DDFFFh,
                       Interrupt 9h
     Node address:  0004ACB7036C
     Frame type:  TOKEN-RING
     Board name:  TOKEN_1_TOK
     LAN protocol:  IPX network 444F2222

IBM Token-Ring Shared RAM
     Version 3.29    August 14, 1995
     Hardware setting: I/O ports 300h to 303h, Memory DC000h to DCFFFh and DD000
h to DDFFFh,
                       Interrupt 9h
     Node address:  0004ACB7036C
     Frame type:  TOKEN-RING_SNAP
<Press ESC to terminate or any other key to continue>
```

Figure 30. The CONFIG Command: 444F2222 is External Network Number

5. **Frame type:** There are four frame types you can select from:

 ***SSAP**:

 *SSAP indicates that the Source Service Access Point (SSAP) uses the ′E0′X SSAP for the IPX circuit. Specifying *SSAP is equivalent to the 802.2 frame type. This frame type can be specified for *ETH, *TRN4M, and *TRN16M line types.

 ***SNAP**:

 *SNAP indicates that the Sub-Network Access Protocol (SNAP) uses the ′AA′ SSAP for the IPX circuit. To run NetWare TCP/IP with source routing bridges, the *SNAP frame type must be specified so an IPX circuit with the *SNAP frame type is associated with the line description.

 ***ETHV2**:

*ETHV2 indicates the IPX circuit is running on Ethernet Version II. No SSAP is used for this IPX circuit. This frame type can only be specified for line types of *ETH. The *ETHV2 frame type is only valid for Ethernet Version 2 lines or an Ethernet line description using an Ethernet standard value of *ALL.

***ETHNTW**:

*ETHNTW indicates the IPX circuit is running on a Novell NetWare 802.3 Ethernet standard. No SSAP is used for this IPX circuit. This frame type can only be specified for a line type of *ETH.

- **Copy NetWare source (CPYNTWSRC):**

 If this is the first time you install NetWare on the Integrated PC Server, this parameter must be *YES. If you have already installed the NetWare source, this parameter is *NO by default. If you then specify *YES, the AS/400 system copies the source again, overlaying what exists on the Integrated PC Server.

- **Vary on configuration (VRYCFG):**

 If you select *YES, the AS/400 system validates the resource name and varies on the network server description that you have just created. If you select *NO, the system neither validates nor varies on the network server.

- **IPX internal network number (IPXNETNBR):**

 This number identifies an individual NetWare server within an IPX network and it must be unique. You can invent a number or let the system generate it for you.

- **Network server storage space (NWSSTG):**

 Enter the name and size of the network server storage space here. If you specify *NWSD for the name, the server storage space name is the same as the name of the server description.

 The size of the network server storage space can be between 100MB and 8000MB. Make sure you specify enough space for the NetWare server code, the NetWare Directory Services (NDS), other NetWare Loadable Modules (NLMs), and any other software you want to keep in the system volume. Since this storage space is used for the NetWare system volume, we recommend that you store all of your application data in other storage spaces and volumes, which you can create later.

- **Integrated PC Server (formerly known as FSIOP) language version (LNGVER):**

 This parameter points to the language version that is associated with the OS/2 Warp layer of the network server and does not relate to the

language version of NetWare 4.1 to be installed. The default is *PRIMARY, which uses the primary national language of your system. If you are not sure which language version is used as primary, you can use the Display Software Resources (DSPSFWRSC) command shown in Figure 31..

```
                          Display Software Resources
                                                                System:   SYSTEM12
Resource
   ID     Option  Feature  Description
5716999   *BASE    5050    AS/400 Licensed Internal Code
5716SS1   *BASE    5050    Operating System/400
5716SS1   *BASE    2924    Operating System/400
5716SS1   *BASE    2925    Operating System/400
5716SS1   1        5050    OS/400 - Extended Base Support
5716SS1   1        2924    OS/400 - Extended Base Support
5716SS1   1        2925    OS/400 - Extended Base Support
5716SS1   2        5050    OS/400 - Online Information
5716SS1   2        2924    OS/400 - Online Information
5716SS1   2        2925    OS/400 - Online Information
5716SS1   7        5050    OS/400 - Example Tools Library
5716SS1   7        2924    OS/400 - Example Tools Library
5716SS1   8        5050    OS/400 - AFP Compatibility Fonts
5716SS1   9        5050    OS/400 - *PRV CL Compiler Support
5716SS1   9        2924    OS/400 - *PRV CL Compiler Support
                                                                          More...
Press Enter to continue.

F3=Exit   F11=Display libraries/releases   F12=Cancel
```

Figure 31. DSPSFWRSC Command

- **NetWare language (NTWLNGID):**

 Specify the NetWare language number and directory associated with the NetWare language you want to use and install from the NetWare CD-ROM. The NetWare language can be different from the OS/400 language. Table 9 shows the NetWare language version.

Table 9 (Page 1 of 2). NetWare Language Version

Language Number	Language
0	French Canadian
1	Simplified Chinese
2	Danish
3	Dutch
4	English
5	Finnish

Table 9 (Page 2 of 2). NetWare Language Version	
Language Number	**Language**
6	French-France
7	German
8	Italian
9	Japanese
10	Korean
11	Norwegian
12	Portuguese-Brazil
13	Russian
14	Spanish-Latin America
15	Swedish
16	Traditional Chinese
17	Polish
18	Portuguese-Portugal
19	Spanish-Spain
20	Hungarian
21	Czech

- **NetWare source directory (NTWSRCDIR):**

 If you entered *YES in the Copy NetWare source parameter, you must specify the source directory for the installation here.

 To find out the name of the volume on a CD-ROM device, enter the following command:

  ```
  DSPOPT VOL(*MOUNTED) DEV(device-name)
  ```

 The device name is the CD-ROM device name on the AS/400 system; you can check it with the following command:

  ```
  WRKCFGSTS CFGTYPE(*DEV) CFGD(*OPT)
  ```

5.2.2 Run the INSNTWSVR Command

After you collect the required information for all the parameters in the INSNTWSVR command, you are ready to start the installation as shown in Figure 32 on page 69.

```
                Install NetWare Server (INSNTWSVR)

Type choices, press Enter.

Network server description . . . > ITSCNTWF      Name, *CPYONLY
Resource name  . . . . . . . . . > CC01          Name
Port 1:

  Line type  . . . . . . . . . . > *TRN16M       *ETH, *TRN4M, *TRN16M
  Local adapter address  . . . . > 4200F00F00F  020000000000-7FFFFFFFFF
  IPX circuit information:
  IPX network number . . . . . . > 444F2222      00000001-FFFFFFFD
  Frame type . . . . . . . . . .   *SSAP         *SSAP,*SNAP,*ETHV2,*ETHNTW
               + for more values
Port 2:
  Line type  . . . . . . . . . .                 *ETH, *TRN4M, *TRN16M
  Local adapter address  . . . .                 020000000000-7FFFFFFFFF
  IPX circuit information:
  IPX network number . . . . . .                 00000001-FFFFFFFD
  Frame type . . . . . . . . . .   *SSAP         *SSAP,*SNAP,*ETHV2,*ETHNTW
               + for more values
                                                              More...
F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys
```

Figure 32. Install NetWare Server (Display 1)

```
                Install NetWare Server (INSNTWSVR)

Type choices, press Enter.

Copy NetWare source  . . . . . > *YES          *YES, *NO
Vary on configuration  . . . . .   *YES         *YES, *NO
IPX internal network number  . .   *RANDOM      00000001-FFFFFFFE, *RANDOM
Server message queue . . . . . .   *JOBLOG      Name, *JOBLOG, *NONE
  Library  . . . . . . . . . . .                Name, *LIBL, *CURLIB
Network server storage space:
  Name . . . . . . . . . . . . .   *NWSD        Name, *NWSD
  Size . . . . . . . . . . . . .   200          100-8000
FSIOP language version . . . . .   *PRIMARY     *PRIMARY, 2963, 2966, 2980...
Country code . . . . . . . . . .   *LNGVER      *LNGVER, 001, 002, 031, 033...
Code page  . . . . . . . . . . .   *LNGVER      *LNGVER, 437, 850, 852, 857...
NetWare language:
  Language number  . . . . . . .   4            0-99
  Language name  . . . . . . . .   *DFT         Name, *DFT
NetWare source directory . . . .   /QOPT/NTW410
                                                 More...
F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys
```

Figure 33. Install NetWare Server (Display 2)

The installation takes some time; a percentage done indication is given at the bottom of the display.

After the code is installed, the configuration descriptions are created automatically. If you specified *YES for the Vary on configuration parameter, the NetWare server description becomes active within a few minutes.

5.3 Additional Software to Install

There is additional software such as the NetWare licenses, NetWare Directory Services, and other NetWare files that need to be installed from a PC client. We use two important NetWare tools, the NetWare Remote Console (RCONSOLE) and the NetWare Administrator Utility (NWADMIN) to finish the installation.

5.3.1 The NetWare Remote Console (RCONSOLE) Function

RCONSOLE is a DOS based application that allows you to manage a NetWare server from any PC client and perform tasks such as:

- Issue a NetWare console command.
- Scan directories and edit text files in both NetWare and DOS partitions on a server.
- Transfer files to a server.
- Manage volumes.
- Install licenses, NetWare Directory Services (NDS), and utilities.

We use this tool to install the additional NetWare software on the Integrated PC Server.

5.3.2 Additional Installation Steps

Run the RCONSOLE program on your NetWare requester workstation and select the NetWare server you just have installed on the Integrated PC Server. The Remote Console utility requires a password. The default password for RCONSOLE is the name of the network server description for your Integrated PC Server on the AS/400 system. After you have logged onto the server, you might want to change the password for security reasons.

If you cannot find the server in the list of available servers, press the Insert key and specify the internal IPX number of your Integrated PC Server. RCONSOLE searches for the server using this number and comes back with the password request.

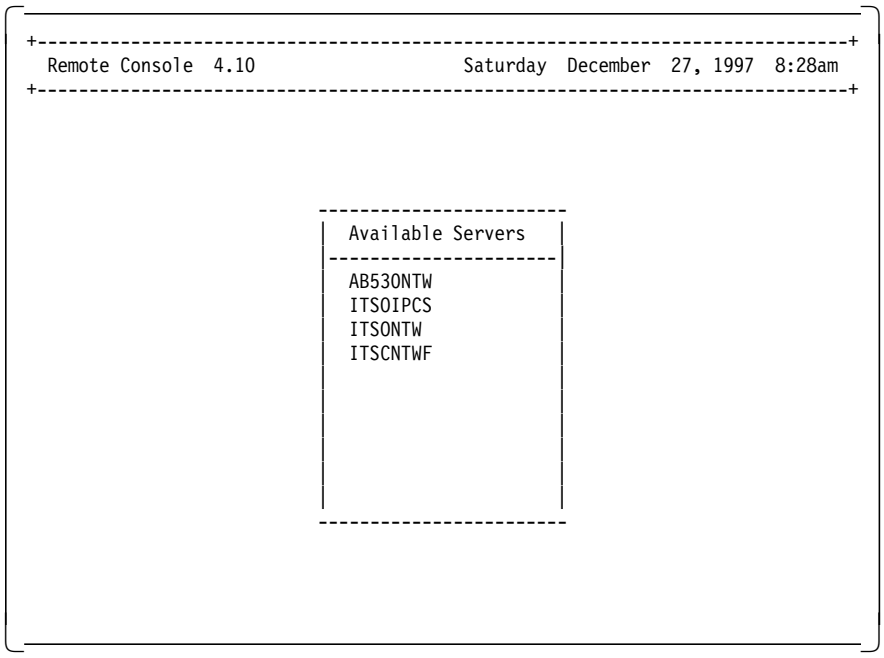


Figure 34. RCONSOLE Server Selection

Once you have entered the password, you see the console window of the new server. Now use the LOAD INSTALL console command to bring up the **Installation Options** menu shown in Figure 35 on page 72.

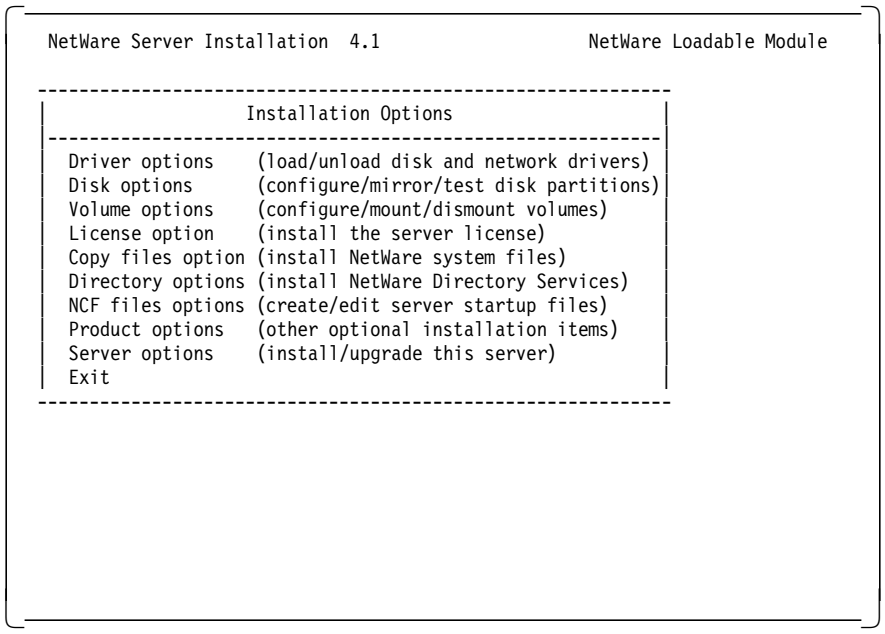


Figure 35. Installation Options Menu

Now perform the following steps:

- From the menu, select **License options** to install the NetWare licenses.

 Press F4 to redirect the installation program to receive input from your local A: drive, insert the license diskette, and press Enter.

- Return to the Installation Options menu and select **Directory options** to install the NetWare Directory Services.
- On the following window, select **Install Directory Services onto this server** as shown in Figure 36 on page 73.

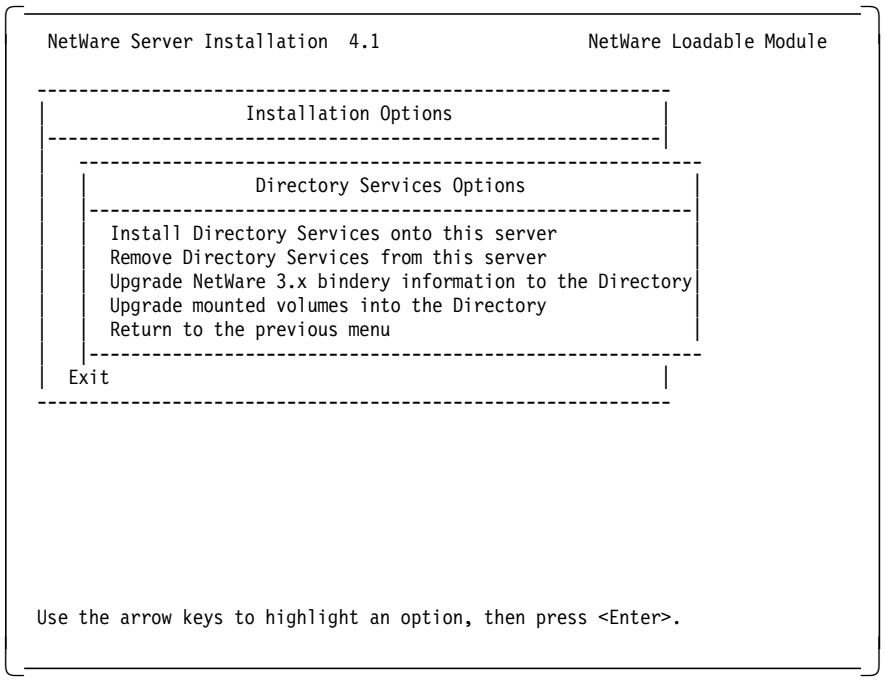


Figure 36. Install Directory Services

You can create a new NDS tree or select one from the list of available trees. If you want to create a new NDS tree, press the Ins key and specify the tree name and time zone. You must specify an **Organization** name here and you may also want to create **Organizational unit** entries.

For more information, please refer to *OS/400 NetWare Integration Support*, SC41-4124.

- Return to the **Installation Options** menu and select **Copy files option** to copy additional NetWare files.

 Insert the NetWare software CD into the CD-ROM drive of your PC and press **F4** to change the path to:

 `G:\NW410\INSTALL\ENGLISH`

 where G: points to the name of the CD-ROM drive. If you install a different language (or depending on the media you use for the installation), the path name is different from the one we used in the preceding example.

You also need to specify the **server boot path** that contains the **SERVER.EXE**. For an Integrated PC Server based server, this is the E: drive of the Integrated PC Server. In the next window, you can specify which files are actually copied to the network server storage space.

You see some warning messages during the copy process due to the fact that some files were already installed when you ran the INSNTWSVR command on the AS/400 system. Ignore these warning messages and continue the process.

- After finishing the copy process, return to a 5250 emulation window and issue the WRKCFGSTS *NWS command shown in Figure 37. Use option 2 to vary off the network server description. **Do not** use the RCONSOLE command DOWN to shut down an Integrated PC Server based NetWare server.

```
                        Work with Configuration Status              SYSTEM12
                                                             03/25/97  17:48:20
Position to  . . . . .               Starting characters

Type options, press Enter.
  1=Vary on   2=Vary off   5=Work with job   8=Work with description
  9=Display mode status ...

Opt  Description       Status               -------------Job--------------
     ITSCNTWF         ACTIVE
       ITSCNTWF01     VARIED ON
       ITSCNTWF02     VARIED ON









                                                                       Bottom
Parameters or command
===>
F3=Exit   F4=Prompt   F12=Cancel   F23=More options   F24=More keys
```

*Figure 37. WRKCFGSTS *NWS*

After the NetWare server has been varied off successfully, use option 1 to vary on the server description.

Part 3. Enhanced Integration for Novell NetWare

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Chapter 6. Description

OS/400 Enhanced Integration for Novell NetWare is an option of OS/400 that provides integration features to communicate to NetWare servers in the network. You can order OS/400 Enhanced Integration for Novell NetWare (5716-SS1 - Option 25) separately as feature 2246 under OS/400 V3R7. This product consists of an AS/400 part and a NetWare server part. Installation on the AS/400 system is done through the RSTLICPGM utility; the NetWare Server part consists of a NetWare loadable module (NLM) for either NetWare 3.12 or 4.1x based servers.

Note

An Integrated PC Server is **not** required to use the Enhanced Integration feature.

This product:

- Provides services for AS/400 users and operators to use NetWare utilities such as files and printers or to perform administration tasks such as volume management for NetWare servers from an AS/400 interface.
- Uses an IPX connection between an AS/400 system and NetWare servers on token-ring, Ethernet, X.25, or frame relay.
- Provides user profile and password integration between the AS/400 system and NetWare servers. AS/400 user or group profiles can be propagated to and synchronized on multiple NetWare Directory Services (NDS) trees or NetWare 3.12 bindery services to establish authenticated connections from OS/400 to NetWare.
- Provides integrated file system support that allows AS/400 users and applications to access files in multiple NDS trees or NetWare 3.12 servers throughout the network. Also, AS/400 Client Access users can access and use files on NetWare servers without having the Novell client code installed.
- Provides AS/400 system to NetWare printing support. Printouts are sent from an AS/400 output queue to a printer queue managed by a NetWare Server. OS/400 host print transform can be used to translate the output to be printed on ASCII based PC printers.

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6.1 The Example Environment

The environment we used to describe the functions of the Enhanced Integration, as shown in Figure 38:

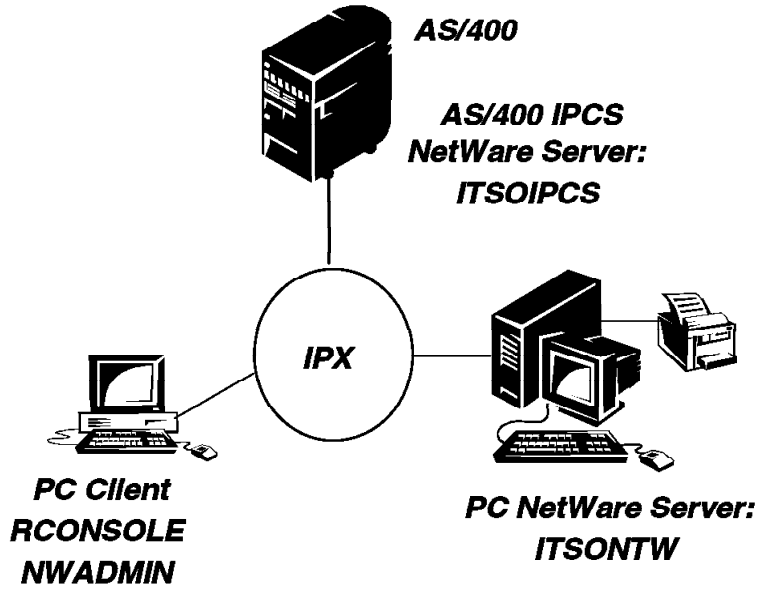


Figure 38. The Example Environment

- AS/400 with IPCS, running OS/400 Version 3 Release 7.
- IPCS running Novell NetWare 4.10.
- PC Server, running Novell NetWare 4.10. A printer IBM4019 is attached to this server.
- A client PC, running the Novell NetWare requester under Microsoft Windows 95. We also use this PC to run the NetWare utilities RCONSOLE (Remote Console) and NWADMIN (NetWare Administrator).

Our NetWare Directory Services (NDS) environment:

- The NDS tree is called **ITSONTW-TREE**
- User profiles and other resources we create in the NDS Organization **ITSONTW-ORG**

Chapter 7. Initial Setup Steps

To set up the Enhanced Integration functions, you must perform several setup steps, depending on the functionality you want to achieve.

- Install Option 25 of OS/400, if not already installed on your system.
- In NetWare, install the Enhanced Integration NLM.
- On the AS/400 system, start the IPX support. For details about the AS/400 support for IPX, please refer to Chapter 2, “IPX Support” on page 11.
- For user profile propagation and synchronization,
 - Add a password to user profile QNETWARE on the AS/400 system.
 - Create user profile QNETWARE in NetWare.
 - Change the network server attributes of the AS/400 system to contain entries for your NDS trees or NetWare 3.12 servers.
 - Set up the network server attributes for the respective user or group profiles to have them enrolled for propagation and password synchronization.
 - For those user profiles not enrolled, to allow seamless user connections from OS/400 to NetWare, create authentication entries for users using NetWare based resources.
- For printing integration, create an output queue on the AS/400 system pointing to a NetWare based print queue.

7.1 Installation of the Enhanced Integration on the AS/400

OS/400 Enhanced Integration for Novell NetWare consists of the option 25 of the Licensed Programs menu for OS/400. You can install the Enhanced Integration feature using the RSTLICPGM command shown in Figure 39 on page 80.

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```
                    Restore Licensed Program (RSTLICPGM)

Type choices, press Enter.

Product  . . . . . . . . . . . . LICPGM       > 5716SS1
Device . . . . . . . . . . . . . DEV          > OPT01
                         + for more values
Optional part to be restored . . OPTION       > 25
Type of object to be restored  . RSTOBJ         *ALL
Language for licensed program  . LNG            *PRIMARY
Output . . . . . . . . . . . . . OUTPUT         *NONE
Release  . . . . . . . . . . . . RLS            *FIRST
Replace release  . . . . . . . . REPLACERLS     *ONLY

                                                                    More...
F3=Exit   F4=Prompt   F5=Refresh   F10=Additional parameters   F12=Cancel
F13=How to use this display        F24=More keys
```

Figure 39. Installation of the Enhanced Integration Feature

In order to activate file system QNETWARE, you must IPL the AS/400 system. Is does not necessarily have to be done after the installation, but can be done at any time that fits into your schedule.

7.2 Installing the Enhanced Integration NLM

For the AS/400 system to communicate with NetWare using the Enhanced Integration feature, a NetWare Loadable Module for either NetWare 3.12 or NetWare 4.1x is provided. We recommend that you load this NLM on all of the NetWare servers in the network.

To install the Enhanced Integration NLM, switch to a Remote Console session and load the INSTALL NLM by typing **LOAD INSTALL** on the console command prompt. The **Install Options** menu shown in Figure 40 on page 81 is shown.

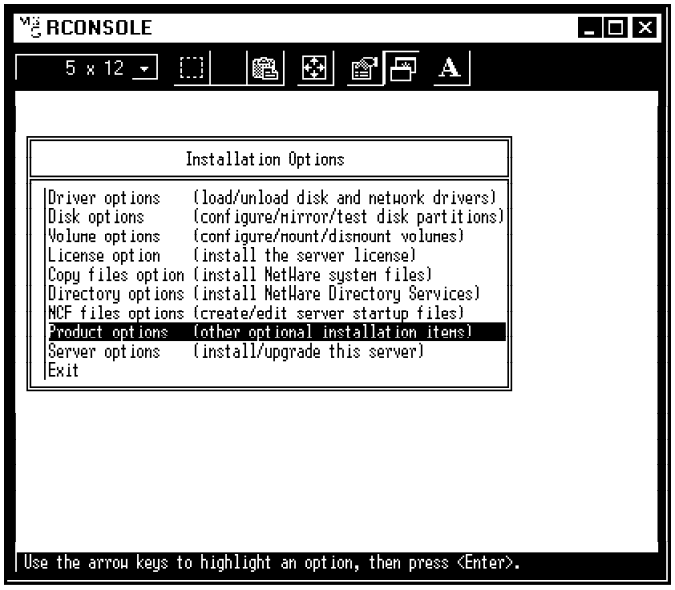


Figure 40. The Install NLM Used to Install Enhanced Integration NLM

Choose **Product options** from the menu and, as shown in Figure 41, specify the menu option **Install a product not listed**.

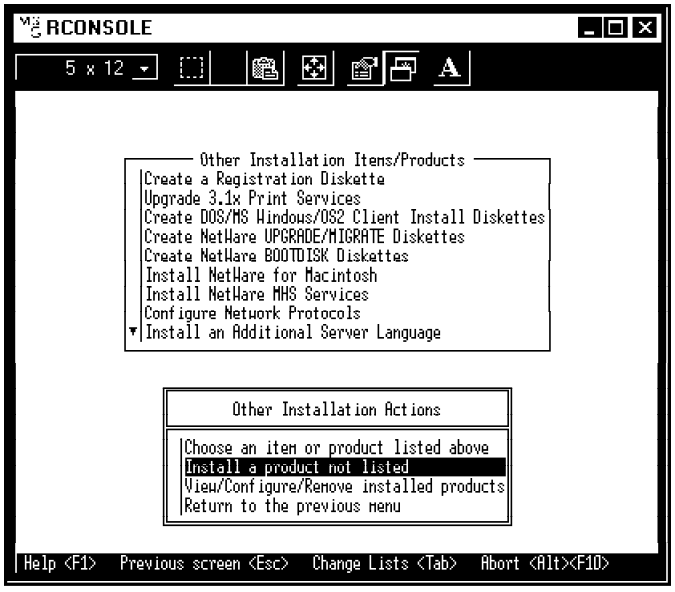


Figure 41. Installing a Product Not Listed

On the next prompt, press **F4** to use the floppy disk drive of your Remote Console PC as the source drive of the installation (see Figure 42 on page 82).

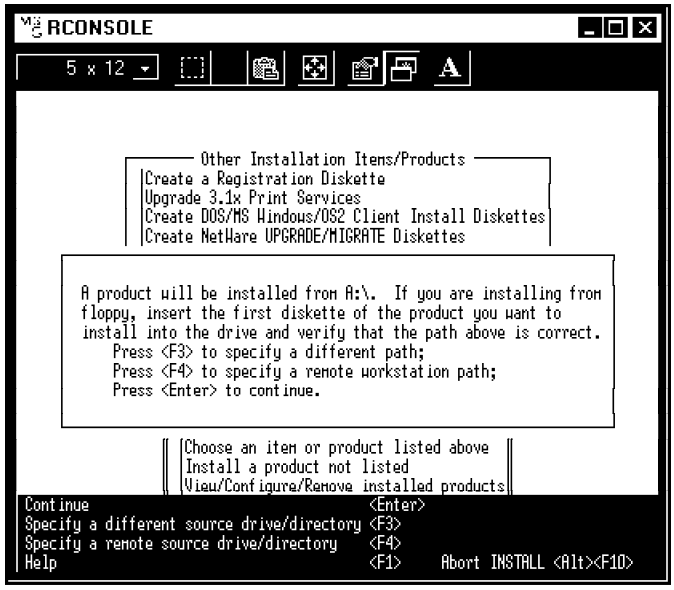


Figure 42. Switching the Installation Path

Specify the remote workstation directory path for the installation. In our example shown in Figure 43 on page 83, we use the **A:** drive.

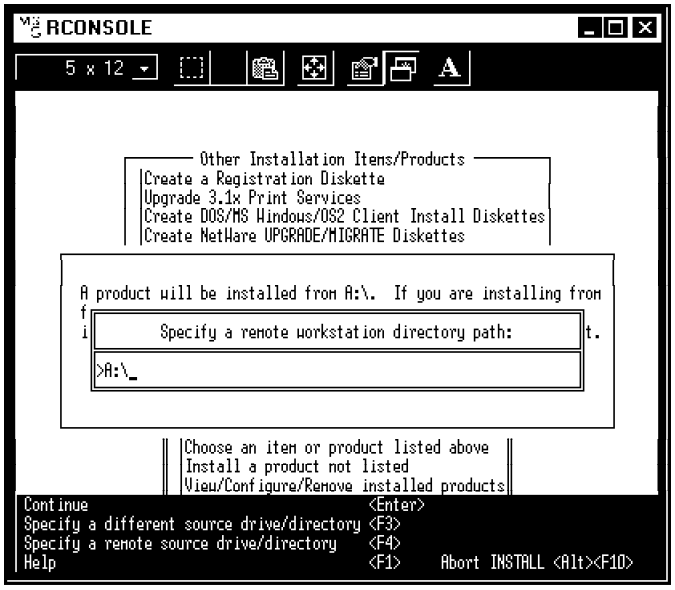


Figure 43. Specifying the Remote Workstation Directory Path

As shown in Figure 44, make sure that all of the file groups are marked for installation.

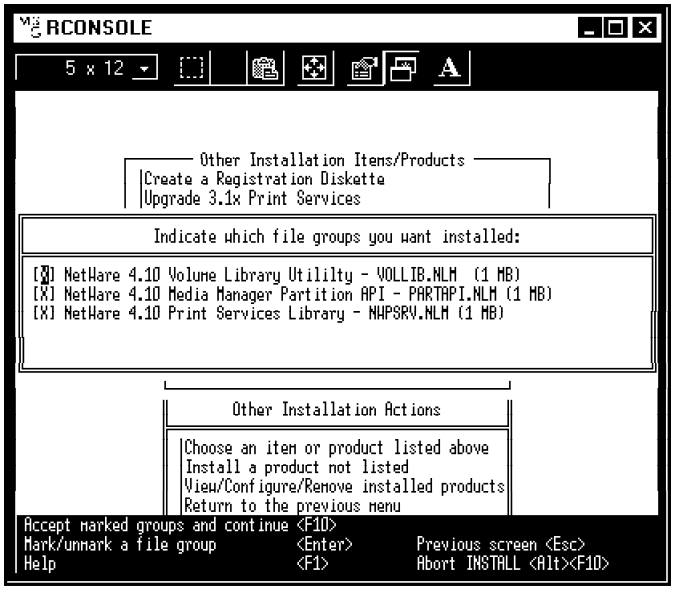


Figure 44. File Groups for Installation of Enhanced Integration NLM

As you can see in Figure 45 on page 84, the destination path of the installation process is the **AS4NW** directory on the **SYS:** volume.

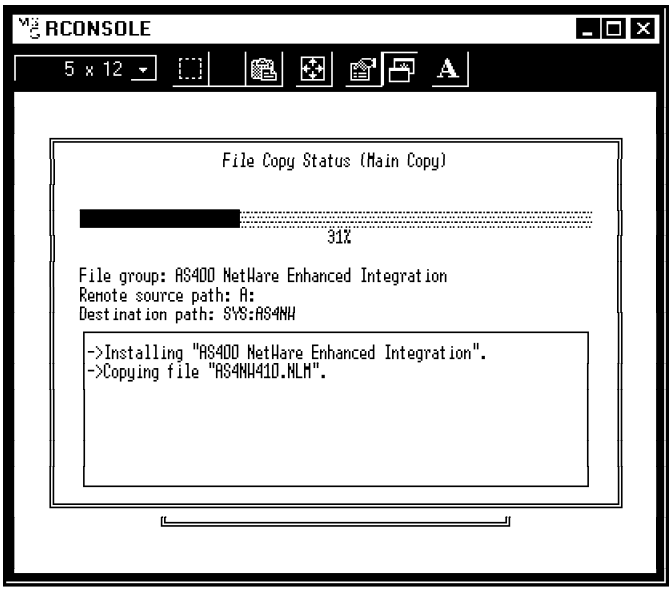


Figure 45. Copying AS4NW410.NLM for Use in NDS Based NetWare Environment

After the installation process has finished, you can load the Enhanced Integration NLM from the Remote Console by typing

```
Load sys:\as4nw\as4nw410.nlm for NetWare 4.10.
```

The output of this command on the NetWare remote console looks similar to Figure 46 on page 85.

```
12-14-97   4:28:39 pm:    DS-4.77-47
     Unable to communicate with server ITSONTW.itsontw-org


12-14-97   4:58:51 pm:    DS-4.77-50
     Established communication with server ITSONTW.itsontw-org


12-14-97   5:45:12 pm:    RSPX-4.10-28
     Remote console connection granted for C6E2C300:407034152374

ITSOIPCS: load sys:\as4nw\as4nw410.nlm
Loading module AS4NW410.NLM
  AS/400 Enhanced Integration NLM
  Version 1.00    June 25, 1996
  5716-SS1 (C) Copyright IBM Corp. 1996. All rights reserved.
  Auto-loading module VOLLIB.NLM
  NetWare Volume Library Utility
  Version 1.01    November 22, 1995
  Copyright 1995 Novell, Inc.  All rights reserved.
  Auto-loading module PARTAPI.NLM
  Media Manager Partition API
  Version 1.00    May 26, 1995
  Copyright 1995 Novell, Inc.  All rights reserved.
ITSOIPCS:
```

Figure 46. Loading the Enhanced Integration NLM

To automate the load process, you may want to enter a command for loading the Enhanced Integration NLM within your NetWare **AUTOEXEC.NCF** file. To do this, use the Remote Console tool to bring up the NetWare Install NLM. From the menu, choose **NCF file options** shown in Figure 47 on page 86.

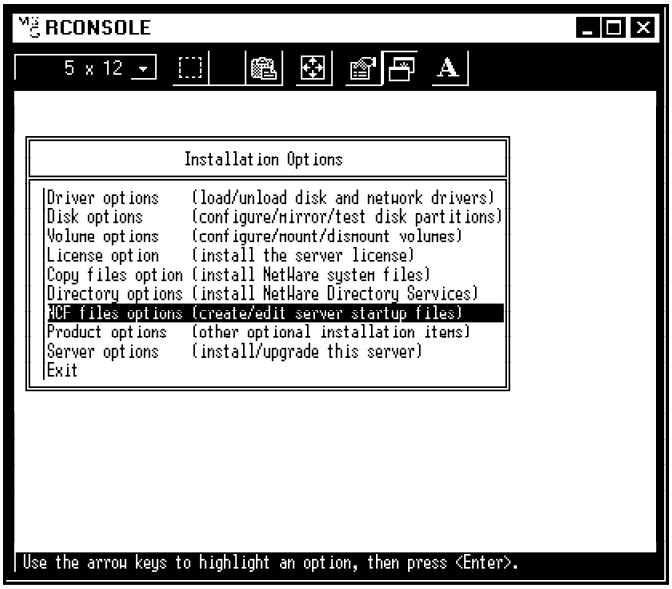


Figure 47. Editing NetWare Control Files

From the menu, choose the **Edit AUTOEXEC.NCF** file shown in Figure 48.

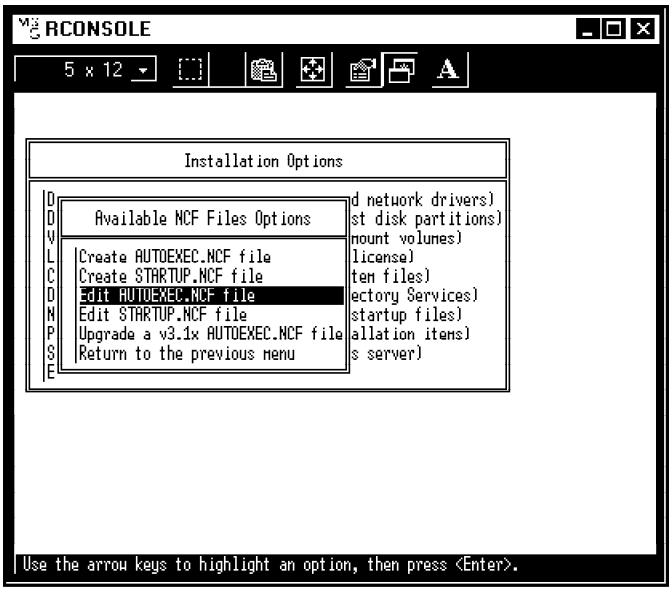


Figure 48. Choosing to Edit the AUTOEXEC.NCF File

Page down to the end of the AUTOEXEC.NCF file and enter the following statement:

```
Load sys:\as4nw\as4nw410.nlm
```

An example is shown in Figure 49.

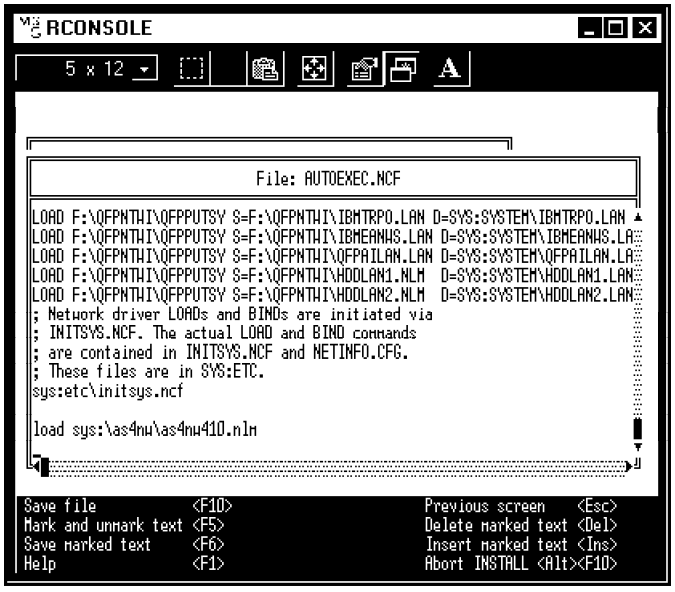


Figure 49. Bringing up the Enhanced Integration NLM Automatically

7.2.1 Verifying that the Enhanced NLM is Running

On the AS/400 system, you can verify that the Enhanced Integration NLM is running:

- Type **WRKIPXSTS** on the command line. The **Work with IPX Status** menu is shown.
- Select option 3, **Display IPX service information**.
- For the NetWare servers running the Enhanced Integration NLM, a service type of *NTWENHINTG is displayed. In our example shown in Figure 50 on page 88, three servers are running the NLM: AB530NTW, ITSOIPCS, and ITSONTW.

```
                      Display IPX Service Information
                                                          System:   SYSTEM10
Type options, press Enter.
  5=Display details

      Service              Service        Remote      Hops to    Service
Opt   name                 Type           Network     Service    Source
      AB53ONTW             *NTWENHINTG    A53OCC12        1      *SAP
      ITSOIPCS             *NTWENHINTG    A51OCCO3        1      *SAP
      ITSONTW              *NTWENHINTG    332DA683        1      *SAP
      AB53ONTW             9000           A53OCC12        1      *SAP
      ITSOIPCS             9000           A51OCCO3        1      *SAP
      ITSONTW              9000           332DA683        1      *SAP

                                                                      Bottom
F3=Exit   F5=Refresh   F6=Print list   F12=Cancel   F17=Top   F18=Bottom
```

Figure 50. Verifying the Enhanced Integration NLM is Running

Chapter 8. Integrated Security

The authentication of users is a fundamental part of the Enhanced NetWare Integration that provides for AS/400 security being fully maintained when accessing the NetWare environment.

So that a user is not required to explicitly log into an NDS tree or a NetWare server, user authentication information can be held in the user profile (server security data object).

To provide seamless access to NetWare based resources for AS/400 users, authentication entries are used to define the login environment to NDS trees and NetWare 3.12 servers for AS/400 users.

An authentication entry contains information about one or more NDS trees or NetWare 3.12 servers to which a user is authorized. The entry can either be created manually or automatically if the user is enrolled for user propagation to the network. When a request is made by an AS/400 job (for example, to access NetWare files in the QNetWare file system) or to use a NetWare based printer, the AS/400 system attempts to start a connection to the server using the information within the authentication entry.

The advantage of the authentication entry is to provide for an automated connection that allows AS/400 users to access NetWare facilities seamlessly. For example, a Client Access user accessing a file in the QNETWARE file system does not need to remember to log in to the tree/server; it is done automatically by the AS/400 system.

Another advantage of the authentication entry is to simplify the handling of multiple contexts and profiles that a single user may have across a multi-tree or multi-server network.

Figure 51 on page 90 shows an example. You can administrate NetWare user profiles from an AS/400 system, both on a NetWare server on an Integrated PC Server and on a PC server. Changing a user's password on the AS/400 system is replicated to NetWare.

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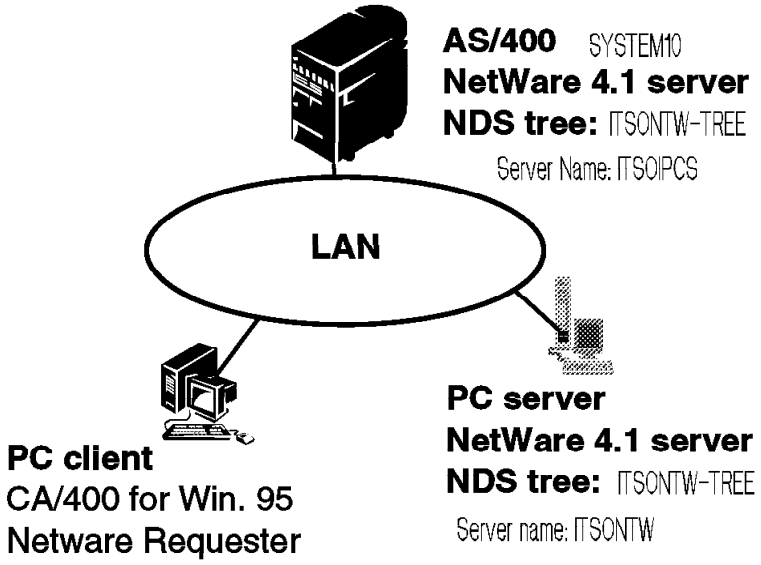


Figure 51. Environment for User Propagation

8.1 Connections to NetWare

Connections from OS/400 or CA/400 jobs to NetWare are ideally started seamlessly, using the authentication and password information stored in the authentication entry for a user profile. If there is no password stored, a connection to the server has to be started manually using the Start NetWare Connection (STRNTWCNN) command shown in Figure 52 on page 91 and Figure 53 on page 93.

The Start NetWare Connection (STRNTWCNN) command starts an authenticated connection to the specified server. This command is used to start a connection when there is no password held in the authentication entry for the server, or a connection shall be started using authentication information different from that specified in the user profile authentication entry. Connections can be authorized to be used only by the current job (AUTJOB(*)), or can be authorized to be used by any job running under the specified user profile (AUTJOB(*ANY)), for example, a batch job. Each user profile can only have one connection per job open to a given server at a time. For NetWare Directory Services trees, connections may be started to each server within the tree. The special value *ALL may be used to start connections to all servers. This can be used, for example, when copying from one server in the tree to another, or copying between partitions of the NDS tree. If multiple connections exist, operations that do not require a

specific server is performed using the first connection started. The NetWare backup services require that each user perform a separate authentication in addition to a normal login. The connection type (CNNTYPE) parameter allows you to specify that a *SAVRST authentication be performed for this purpose.

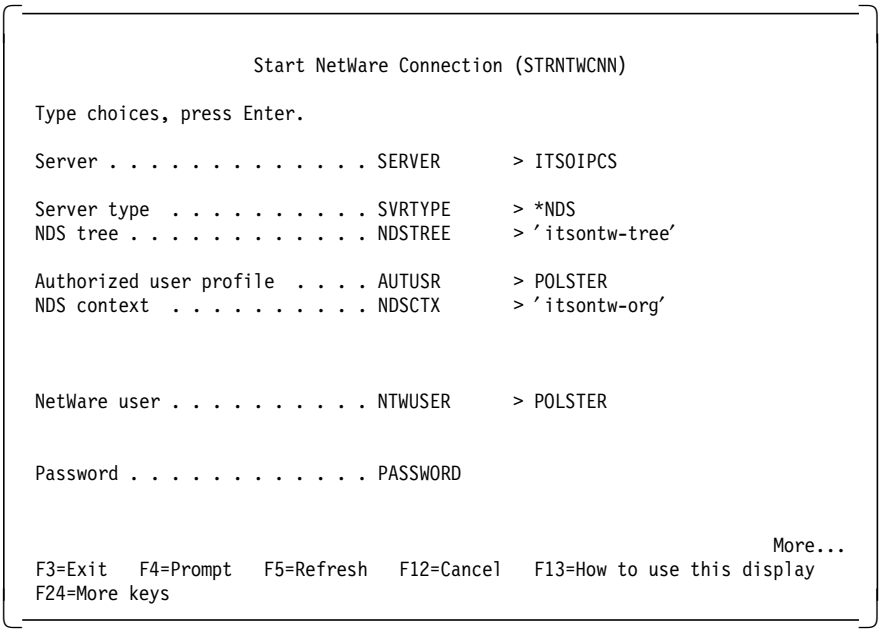


Figure 52. Starting a NetWare Connection Manually, Display 1

Important parameters for this command are

- **Server:**

 Here you have to indicate which server is used to connect to. You can either enter the name of a specific server or specify:

 - *any, then any one of the servers in an NDS tree is chosen by the system.
 - *all, then a connection to each of the servers within the NDS tree is started.

- **SVRTYPE:**

 Here the NetWare environment is important. You can specify:

 - *NetWare3 for a server running NetWare 3.12.
 - *NDS for a server running in a NetWare NDS tree.

- **NDSTREE:**

This parameter is only important when you have specified *NDS for the **SVRTYPE** parameter.

- **AUTUSR:**

 Here you enter the name of the OS/400 user profile you want to start a connection for.

- **NDSCTX:**

 This parameter is only important when you have specified *NDS for the **SVRTYPE** parameter.

 You can enter the context for the NetWare user or specify *AUTE to point to the information held in the authentication entry.

- **NTWUSER:**

 Here you can enter the name of a valid user in NetWare or specify:

 – *AUTE to use information from the authentication entry.

 – *USRPRF to use the same name as in the OS/400 user profile entered in the **AUTUSR** parameter.

- **PASSWORD:**

 Enter the password or specify:

 – *AUTE to use the password information from the authentication entry.

 – *NONE if no password verification is used in NetWare.

```
                    Start NetWare Connection (STRNTWCNN)

Type choices, press Enter.

Connection type  . . . . . . . . CNNTYPE        *USER

Connection idle time . . . . . . CNNIDLTIME     *NOMAX

                                                                      Bottom
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
```

Figure 53. Starting a NetWare Connection Manually, Display 2

- **AUTJOB:**

 Here you indicate what kind of connection to establish.

 – The connection can only be used by the current job; enter *****.

 – You can use the connection for all jobs running under the same user profile. Specify ***any**.

 Note

 If you have to access the QNETWARE file system, you need a connection for the current job.

 Printing integration requires an AUTHOB(*ANY) if a connection cannot be started using the authentication entry.

- **CNNTYPE:**

 For NetWare backup reasons, specify which kind of connection to use.

 – *SAVRST: The connection is started to use NetWare backup utilities.

 – *USER: A normal authentication will be performed.

 – *ALL: Both *USER and *SAVRST authentications take place.

- **CNNIDLTIME:**

The time the connection can stay active while idle.

8.2 System Value QRETSVRSEC

The OS/400 system value Retain Server Security Data (QRETSVRSEC) determines whether password information needed by a server to authenticate a user in NetWare can be stored in an encrypted way on the host system. If the system value is set to 1 as shown in Figure 54, seamless connections from OS/400 jobs to NetWare resources are possible using the password information you specified in the ADDNTWAUTE command. Also. if a user is enrolled for propagation, password changes on the AS/400 can be propagated to the NetWare environment. If you choose to have QRETSVRSEC set to 0, a connection for a job has to be started manually using the STRNTWCNN command.

```
                              Change System Value

System value . . . . . :   QRETSVRSEC
Description  . . . . . :   Retain server security data


Type choice, press Enter.

  Retain server security
    data . . . . . .   1             0=Do not retain data
                                     1=Retain data









F3=Exit   F5=Refresh   F12=Cancel
```

Figure 54. System Value QRETSVRSEC

8.3 Authentication Entries

The Add NetWare Authentication Entry (ADDNTWAUTE) command shown in Figure 55 on page 95 adds authentication information for a server or tree to a user profile. The information specifies how the user signs on to the server or into the tree, and is also used to start authenticated connections to

servers. An authenticated connection to a server is required to issue requests to the server. If an authenticated connection does not exist, the system attempts to start a connection using data stored in the authentication entries.

```
                    Add NetWare Aut Entry (ADDNTWAUTE)

Type choices, press Enter.

Server type  . . . . . . . . . . SVRTYPE      > *NDS
NDS tree . . . . . . . . . . . . NDSTREE      > 'itsontw-tree'

User profile . . . . . . . . . . USRPRF       > POLSTER
NDS context  . . . . . . . . . . NDSCTX       > 'itsontw-org'



NetWare user . . . . . . . . . . NTWUSER      > *USRPRF


Password . . . . . . . . . . . . PASSWORD       banana




                                                                      Bottom
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
```

Figure 55. Adding an Authentication Entry for User Polster

The parameters for this command are:

- **SVRTYPE:** The type of the authentication entry:
 - *NETWARE3: a NetWare 3.x server
 - *NDS: a NetWare Directory Services tree
- **NDSTREE** or **SERVER:** The name of the NetWare Directory Services tree or the name of the server for which the authentication entry is being added.
- **USRPRF:** The user profile to which the authentication entry is added.
- **NDSCTX:** Only used for server type *NDS. The NetWare Directory Services context in which the user name is defined.
- **NTWUSR:**
 - *USRPRF: Use the same name as the name of the AS/400 user profile (USRPRF parameter) for logging into NetWare.

- A different user name than on the AS/400 is used for logging into NetWare.

- **PASSWORD:** Specifies the password used to authenticate the user to the server.
 - *NONE: No password is needed to verify authority.
 - *STRNTWCNN: No password is stored as part of the authentication entry. A Start NetWare Connection (STRNTWCNN) command has to be issued in order to be able to connect to the server. Refer to Section 8.1, “Connections to NetWare” on page 90 for more information about the STRNTWCNN command.
 - A password to be used for NetWare is issued and also stored in a server security object. This is only possible if system value QRETSVRSEC, Retain Server Security Data, is set to 1.

8.4 User Enrollment for Propagation and Synchronisation

You can take full advantage of the improved integration between your AS/400 system and your NetWare environment using the function of user enrollment for propagation and synchronization.

Users enrolled use the same user profile and password in NetWare as on the AS/400. Password changes on the AS/400 will be sysnchronized in the NetWare environment. This is done by AS/400 job QNETWARE, running in the QSYSWRK subsystem.

8.4.1 Setting Up User Profile QNETWARE

The QNETWARE user profile is used to run the tasks for user profile propagation and synchronization between the AS/400 and NetWare. User profile QNETWARE is created on the AS/400 with the installation of the Enhanced Integration feature. We have to assign a password to QNETWARE on the AS/400 and to create the QNETWARE user profile in our NetWare environment. The password has to be the same in both environments for the QNETWARE job to be able to perform password propagation and synchronization.

8.4.1.1 Assigning a Password to QNETWARE on the AS/400 System

On the AS/400 system, use the Change User Profile (CHGUSRPRF) command shown in Figure 56 on page 97 to assign a password to the QNETWARE user profile.

```
                      Change User Profile (CHGUSRPRF)

Type choices, press Enter.

User profile . . . . . . . . . . USRPRF       > QNETWARE
User password  . . . . . . . . . PASSWORD     > BANANA
Set password to expired  . . . . PWDEXP         *NO
Status . . . . . . . . . . . . . STATUS         *DISABLED
User class . . . . . . . . . . . USRCLS         *USER
Assistance level . . . . . . . . ASTLVL         *SYSVAL
Current library  . . . . . . . . CURLIB         *CRTDFT
Initial program to call  . . . . INLPGM         *NONE
  Library  . . . . . . . . . . .
Initial menu . . . . . . . . . . INLMNU         MAIN
  Library  . . . . . . . . . . .                  *LIBL
Limit capabilities . . . . . . . LMTCPB         *NO
Text 'description' . . . . . . . TEXT           'QFPNTWE USER PROFILE 510'



                                                                      Bottom
F3=Exit   F4=Prompt   F5=Refresh   F10=Additional parameters   F12=Cancel
F13=How to use this display        F24=More keys
```

Figure 56. Assigning a Password to User Profile QNETWARE

Note

The *Status* parameter for this user profile is always set to **DISABLED**. Therefore, no one can use QNETWARE to sign on to the system interactively.

8.4.1.2 Setup of QNETWARE in NetWare

Use the NWADMIN tool to set up user profile QNETWARE in NetWare. Click on the container object you want to use. In our example, we choose the NDS organization *itsontw-org* as the location for the QNETWARE user profile. Switch to the menu bar and click **Object** and **Create**. On the **New object** window, select **User** as shown in Figure 57 on page 98.

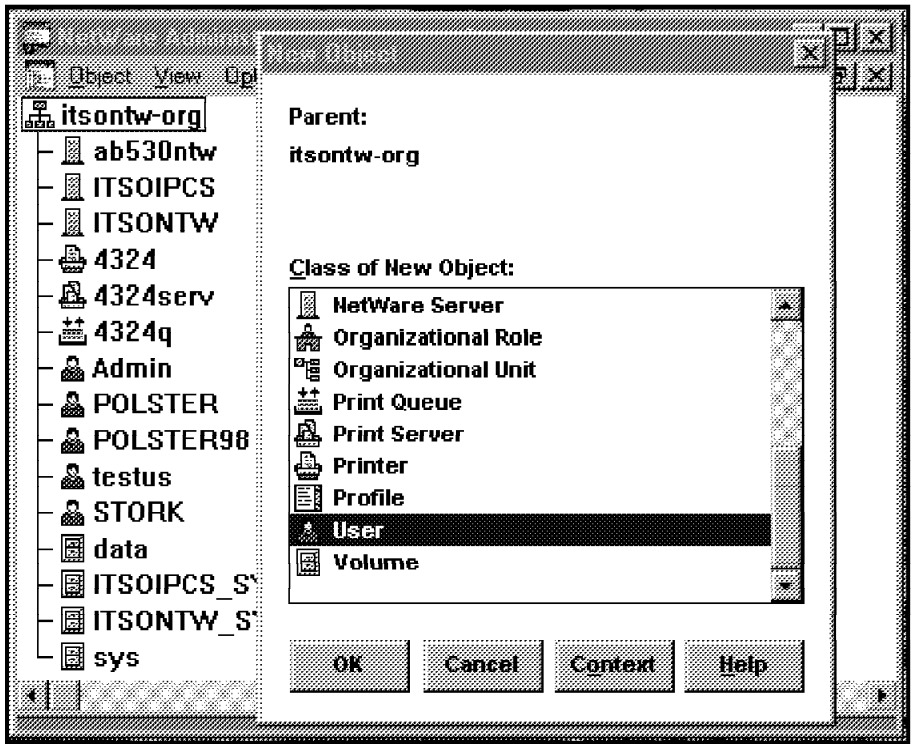


Figure 57. Creating User Profile QNETWARE

On the **Create User** window shown in Figure 58 on page 99, enter *qnetware* in the **Login Name** field, and check the **Define Additional Properties** box. Then press the **Create** button.

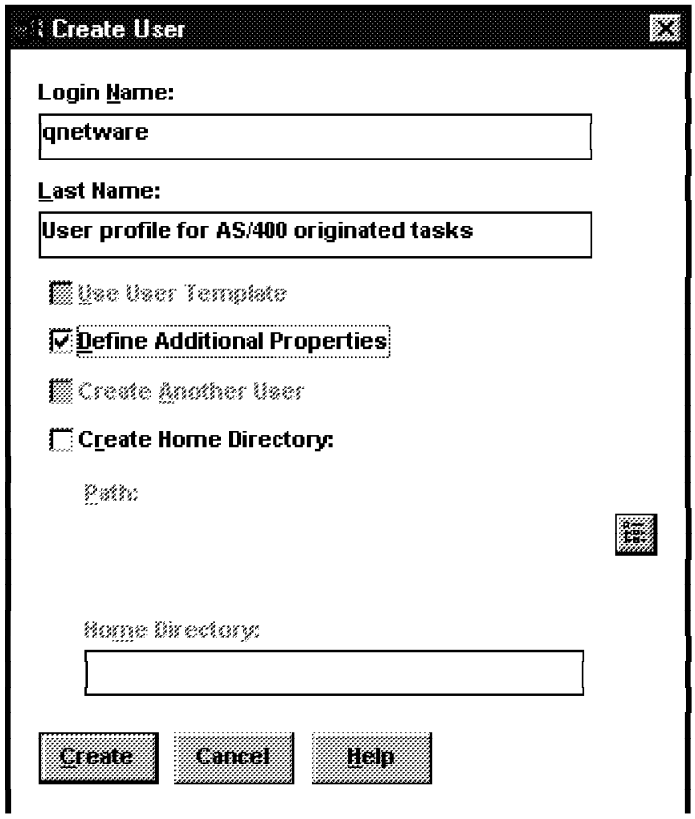


Figure 58. Creating User Profile QNETWARE, Step 2

On the **User: qnetware** window, press the **Security Equal To** button; then click the **Add** button. Search for the icon representing the NetWare **Admin** user. Click on the **Admin** entry; then click on the **Ok** button. The result looks similar to our example in Figure 59 on page 100. Click on **OK** to finish the *Security Equal To* dialog.

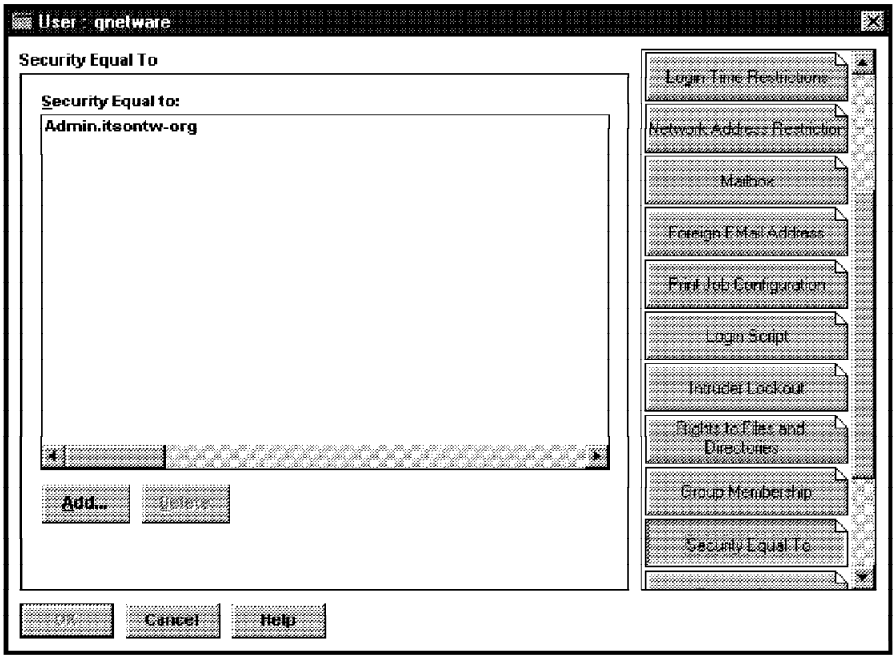


Figure 59. Assigning NetWare Administrator Rights to QNETWARE

On the **User: qnetware** window, click on the **Password Restrictions** button to bring up the **Password Restrictions** dialog. Check the **Require a Password** box, and click on the **Change Password** button. In the *Change Password* window shown in Figure 60 on page 101, specify the same password as you assigned to user QNETWARE on the AS/400 system. Click on the **Ok** button to finish.

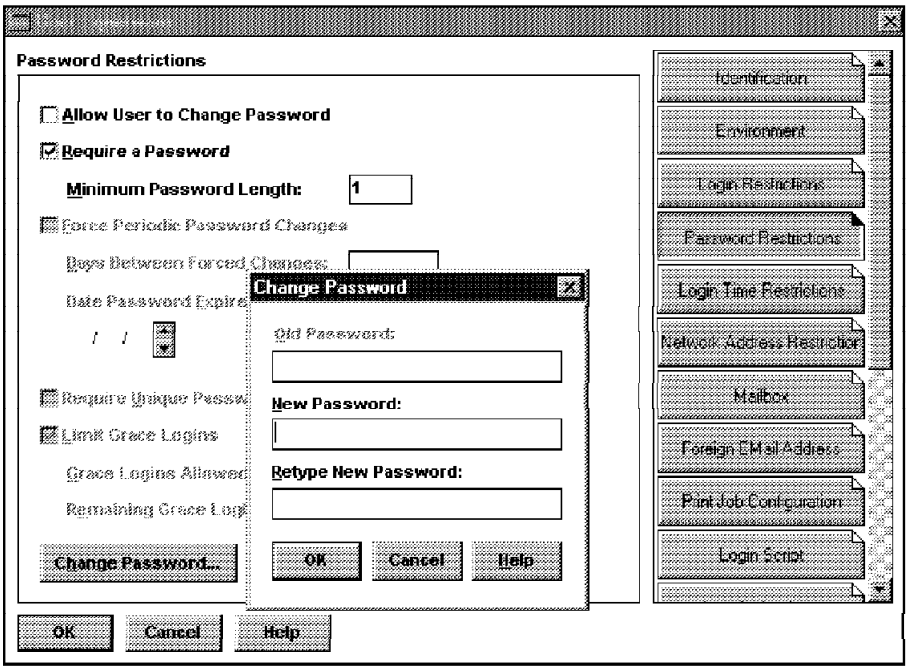


Figure 60. Assigning a Password to QNETWARE

8.4.2 The Network Server Attributes

The network server attributes (NWSA) store the default system wide tree and context. This simplifies using many integration commands where instead of specifying a long context name, you can just specify *NWSA.

The Change Network Server Attributes (CHGNWSA) command shown in Figure 61 on page 102, Figure 62 on page 103, and Figure 63 on page 104 changes the network server attributes of the system. Many of these attributes can be set on an individual user profile basis using the CHGNWSUSRA command. Many network server commands such as DSPNWSUSR and WRKNWSSTS specify that information from the network server attributes should be used by specifying *NWSA for a given parameter.

```
                        Change NWS Attributes (CHGNWSA)

Type choices, press Enter.

Prompt control . . . . . PMTCTL         *ALL
Default server type  . . . . . DFTSVRTYPE     *NETWARE
NDS tree . . . . . NDSTREE      > 'itsontw-tree'

NDS context  . . . . . NDSCTX       > 'itsontw-org'

                                                                      More...
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
```

Figure 61. Changing the Network Server Attributes, Display 1

Important parameters on this display are:

- **DFTSVRTYPE**:

 The default server type for the system. In our case, the parameter should be set to *NETWARE. Since the network server attributes are defined as a matter of convenience for OS/400 commands dealing with multiple network types, specify the server type you use the most.

 If the default server type is not set, it defaults to *LANSERVER.

 The possible values are:

 – *NETWARE: When *NETWARE is specified, both NetWare 3.12 and NDS servers are included.

 – *BASE: The default server type is *BASE.

 – *LANSERVER: The default server type is *LANSERVER.

- **NDSTREE:**

 The default NetWare Directory Services tree used by the system. It makes sense to specify the tree that is used the most by AS/400 users when working with NetWare resources from the AS/400 system.

- **NDSCTX:**

The path of the NetWare Directory Services context to be used as a default in AS/400 commands relating to NDS resources such as ADDNTWAUTE or CHGNWSUSRA.

```
                        Change NWS Attributes (CHGNWSA)

Type choices, press Enter.

NDS tree list:                   NDSTREELST
  NDS tree . . . . . .                        'ABAS400TREE'

  User object context  . . . . .              'IBM'

  Default server . . . . . .                  *ANY

  Profile object . . . . . .                  *NONE

                                                                        More...
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
```

Figure 62. Changing the Network Server Attributes, Display 2

Important parameters on this display are:

- **NDSTREELST:**

 The list of default NDS tree names used by OS/400 to enroll AS/400 profiles into NetWare. Each entry in the list contains a different NDS tree name and respective attributes.

 The parameter consists of four values:

 1. The name of the NDS tree where OS/400 user profiles are enrolled.
 2. The context within the NDS tree where newly created NDS user objects are created when enrolling AS/400 users into the NDS tree. If the user object already exists in the NDS tree, it is moved to this context OS/400 profile. The name must be specified fully distinguished.
 3. The default NetWare Directory Services server to be used when enrolling or synchronizing AS/400 user profiles within NDS.
 4. The NDS profile object containing the login script for the user profile when logging into NetWare.

```
                        Change NWS Attributes (CHGNWSA)

Type choices, press Enter.

   User object context  . . . . .             > 'itsontw-org'

   Default server . . . . . .                  > ITSONTW

   Profile object . . . . . .                    *NONE

                           + for more values
 NetWare 3.12 server list . . . . NTW3SVRLST     NTW312

                           + for more values



                                                                        Bottom
 F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
 F24=More keys
                                    .
```

Figure 63. Changing the Network Server Attributes, Display 3

Important parameters on this display are:

- **NTW3SVRLST:**

 The default list of up to 100 NetWare 3.12 servers where OS/400 is used to enroll AS/400 user profiles.

8.4.3 The Network Server User Attributes

The Change Network Server User Attributes (CHGNWSUSRA) command shown in Figure 64 on page 105 and Figure 65 on page 105 is used to change attributes for a specific OS/400 user or group profile that works with network based resources from OS/400 or CA/400. Using this command, you can:

- Set network server attributes for a specific user or group profile. For example, the default NetWare Directory Services Tree name can be set for a specific user profile.
- For NetWare networks, the network server attributes can be set up so that this user or group profile is enrolled into the NetWare network. Where the profile is enrolled depends on the values specified by the NDSTREELST and NTW3SVRLST parameters.
- When an OS/400 group profile is enrolled, a matching NetWare group is created in the network. If PRPGRPMBR(*ALL) is specified on the command, all OS/400 user profiles that are in the group are enrolled into the network and put into the newly created group.

```
                    Change NWS User Attributes (CHGNWSUSRA)

Type choices, press Enter.

User profile . . . . . . . . . . USRPRF       > POLSTER
Profile type . . . . . . . . . . PRFTYPE        *USER
Prompt control . . . . . . . . . PMTCTL         *ALL
Default server type  . . . . . . DFTSVRTYPE     *NETWARE
NDS tree . . . . . . . . . . . . NDSTREE        'ITSONTW-TREE'

NDS context  . . . . . . . . . . NDSCTX         'itsontw-org'

                                                                      More...
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
```

Figure 64. Changing Network Server User Attributes

```
                    Change NWS User Attributes (CHGNWSUSRA)

Type choices, press Enter.

NDS tree list:                   NDSTREELST
  NDS tree . . . . . . . . . . .                'ITSONTW-TREE'

  User object context  . . . . .                'itsontw-org'

  Default server . . . . . . . .                *ANY

  Profile object . . . . . . . .                *NONE

                          + for more values
NetWare 3.12 server list . . . . NTW3SVRLST     *NONE

                          + for more values



                                                                      Bottom
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
```

Figure 65. Changing Network Server User Attributes (Continued)

The parameters of this command have the following meaning:

- **NDSTREE:** Specifies the name of the default NetWare Directory Services tree used by this user. The tree specified should be the one most often used by this OS/400 user when accessing the network.
- **NDSCTX:** Specifies the complete path name of a default NetWare Directory Services context associated with the tree specified by the NDSTREE parameter to be used when this user issues OS/400 commands that use NDS objects. This becomes the current context when the OS/400 user signs on.
- **NDSTREELST:** Specifies a default list of NetWare Directory Services trees that is be used by the OS/400 network administration support to determine which NetWare v4.x trees to enroll this OS/400 profile to. Each entry in the list contains an NDS tree name and a list of default attributes associated with that tree. Up to 10 entries can be specified for this parameter. An entry consists of a value from each of the following elements. A value must be specified for each of the four elements for each entry. Specify the name of the NetWare Directory Services tree where the OS/400 network administration support can enroll OS/400 profiles into.

 The second element in this parameter specifies the location in the NDS tree where newly created NDS user objects are created when enrolling AS/400 profiles into the NDS tree. If the user object already exits in the NDS tree, it is moved to this context the first time the OS/400 administration support attempts to enroll the OS/400 profile. The NetWare complete name must be specified for this element. Specify the NDS context where AS/400 profiles are enrolled into the NDS tree.

 The third element in this parameter specifies the default NetWare Directory Services server to be used by the system when enrolling AS/400 profiles into the NDS tree.

 *ANY: The system selects any active server to use when accessing the NDS tree, or specify the name of the default NDS server to be used by the system when enrolling AS/400 profiles into the NDS tree. If this server is unavailable at the time the request is handled, the system attempts to find an active server that is available to handle the request.

 The fourth element in this parameter specifies a default NetWare Directory Services profile object that contains the profile login script to be used by the user when logging into the network. The NetWare distinguished name must be specified for this element. If you do not use a profile object, enter *none; otherwise, specify the distinguished name of the default NDS profile object containing the profile login script to be used by a user when logging into the network.

- **NTW3SVRLST:** Specifies a default list of up to 100 NetWare 3.12 servers that this OS/400 user profile is enrolled into. Specify the name of a NetWare 3.12 server that this AS/400 user is authorized to login to.

Chapter 9. Administration

There are a number of administration utilities provided with both of the NetWare Integration products. If you use OS/400 Integration for Novell NetWare, you can:

- Submit a console command to an Integrated PC Server based NetWare server using the SBMNWSCMD command.
- Manage network server storage spaces using the CRTNWSSTG, WRLKNWSSTG, and ADDNWSSTGL commands.
- Monitor the IPX status using the WRKIPXSTS command.

If you use OS/400 Enhanced Integration for Novell NetWare, you can:

- Set up OS/400 user profiles for propagation and synchronization using the CHGNWSA and CHGNWSUSRA commands.
- Monitor the enroomment for user profiles using the WRKNWSENR command.
- Start and monitor NetWare connections using the STRNTWCNN and WRKNTWCNN commands.
- Manage NetWare volumes, both on Integrated PC Servers and PC based NetWare servers using the CRTNTWVOL and WRKNTWVOL commands.

9.1 Submit a Command to a NetWare Server

The Submit Network Server command submits a command to run on a NetWare server independently if the server resides on an Integrated PC Server or is a PC server in the network. The output is directed to the job log of the job that started the command.

On an AS/400 command line, enter:

```
SBMNWSCMD
```

and for **F4** for prompting. An input display in the example in Figure 66 on page 110 is shown.

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```
                  Submit Network Server Command (SBMNWSCMD)

Type choices, press Enter.

Command  . . . . . . . . . . . . CMD          > MODULES


Server . . . . . . . . . . . . . SERVER       > ITSONTW

Server type  . . . . . . . . . . SVRTYPE      > *NETWARE
Command type . . . . . . . . . . CMDTYPE      > *NETWARE









                                                                      Bottom
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
```

Figure 66. Display Installed Licensed Programs

Important parameters for this command are:

- **CMD**

 The command submitted to the network server. No syntax check takes place.

- **SERVER**

 The name of the server this command is submitted to.

- **SVRTYPE**

 The type of server to which the command is sent. Since the SBMNWSCMD command can be used for any type of server software running on an Integrated PC Server, there is also the possibility to send commands to *LANSERVER or to *Base type of Integrated PC Server. In our case, depending on the setup of the network server attributes for the system and the network server user attributes for the user issuing the command, we can use

 – *NETWARE: The server type is NetWare. Since the NetWare server on an Integrated PC Server is running under OS/2, both OS/2 and NetWare commands can be sent to a local, Integrated PC Server based NetWare server. For example:

```
SBMNWSCMD CMD('type config.sys') SERVER(ITSOIPCS) SVRTYPE(*NETWARE)
CMDTYE(*OS2)
```

- *NWSA: The server type specified in the network server attributes is used as specified in the CHGNWSA command.
- *NWSUSRA: The server type specified in the network server attributes for the user profile running command is used, as specified in the CHGNWSUSRA command.

- **CMDTYPE**

 The type of command string used in the CMD parameter. The system determines what type of processing needs to take place. We can use the following values.

 - *NETWARE: The command string is a NetWare command.
 - LCLNTW: You can use this value to submit a NetWare command if the *NETWARE command type value does not work. *LCLNTW can only be used to submit a command to a local Integrated PC Server based NetWare server. *LCLNTW uses a different communication path to send commands to the network server.
 - *OS2: We send an OS/2 command to a NetWare based Integrated PC Server.
 - *SVRTYPE: Points to the value in the SVRTYPE parameter. If the server is a NetWare server, the command string is assumed to be a NetWare command.

To review the output from the SBMNWSCMD command, you can, for example, use the **QCMD** interface, or start:

```
DSPJOBLG
```

command on an AS/400 command line. Then press the **F10** key to display detailed messages. In Figure 67 on page 112, the output of the following command is shown:

```
SBMNWSCMD CMD(MODULES) SERVER(ITSONTW) SVRTYPE(*NETWARE)
CMDTYPE(*NETWARE)
```

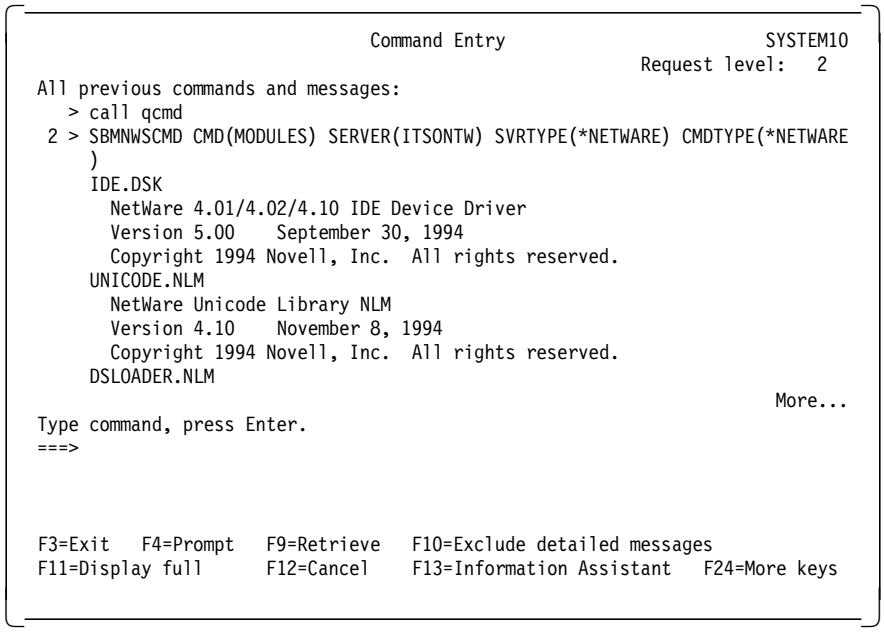


Figure 67. The SBMNWSCMS Command to the NetWare Layer

In Figure 68 on page 113, the output of the following command is shown:

```
SBMNWSCMD CMD('type c:config.sys') SERVER(ITSOIPCS)
SVRTYPE(*NETWARE) CMDTYPE(*OS2)
```

```
                                Command Entry                        System10
                                                                Request level:   2
All previous commands and messages:
 2 > SBMNWSCMD CMD('type c:config.sys') SERVER(ITSOIPCS)
 SVRTYPE(*NETWARE) CMDTYPE(*OS2)
     REM Installed memory = 049152K        Usable memory = 049152K
     PAUSEONERROR=NO
     BASEDEV=OS2DASD.DMD
     BASEDEV=DTAERR01.SYS
     BASEDEV=DTANDD01.SYS
     BASEDEV=VDD400R.ADD /0000000006
     BASEDEV=NWDLOGIN.SYS
     BASEDEV=VT400.SYS /T:6506 /P:R
     SET OS2_SHELL=D:\OS2\CMD.EXE
     SET COMSPEC=D:\OS2\CMD.EXE
     LIBPATH=D:\OS2\DLL;C:\;D:\;D:\IBMCOM\DLL;D:\MPTN\DLL;D:\SPM2V2;D:\OS2\MDO
                                                                        More...
Type command, press Enter.
===>



F3=Exit   F4=Prompt   F9=Retrieve   F10=Exclude detailed messages
F11=Display full      F12=Cancel    F13=Information Assistant   F24=More keys
```

Figure 68. The SBMNWSCMS Command to the OS/2 Layer

9.1.1 Work with NWS Enrollments

The Work with Network Server User Enrollment display shown in Figure 69 on page 114 allows you to perform the following functions associated with enrolling and managing OS/400 users and groups being enrolled into NetWare servers or NDS trees:

- Change or display a user profile.
- Change or display the network attributes for a user.
- Display the message description for those entries that have an error code displayed.

```
                      Work with NWS User Enrollment
                                                              System:   SYSTEM10
Type options, press Enter.
  2=Change user profile   5=Display user profile   6=Retry entry
  14=Change network user attributes   15=Display network user attributes
  16=Display error details

     Tree/Server                   Enrollment  Error
Opt    Profile           Type      status      code    Text
       STORK             *USER     *CURRENT            E.  Stork, S510
     ITSONTW-TREE        *NDSTREE
       POLSTER           *USER     *CURRENT            t. Polster, Technica
       POLSTERNO         *USER     *UPDFAIL    -30004  t. Polster, Technica
       POLSTER3          *USER     *CURRENT            t. Polster, Technica
       POLSTER5          *USER     *CURRENT            t. Polster, Technica
       POLSTER98         *USER     *CURRENT            t. Polster, Technica
       QNETWARE          *USER     *CURRENT            QFPNTWE USER PROFILE
       STORK             *USER     *CURRENT            E.  Stork, S510
                                                                        Bottom
Parameters or command
===>
F3=Exit   F4=Prompt   F5=Refresh   F6=Print list   F9=Retrieve
F10=Display groups    F12=Cancel   F17=Position to
```

Figure 69. Work with NWS User Enrollment

The current state of the user profile enrollment attempts to use that particular tree or server. The values are:

- *CURRENT means that the user profile has been enrolled successfully to the tree or server and that the passwords should be in synchronization.
- *UPDPND (Update pending) indicates that the profile has changed on the AS/400 system but the updates have not been successfully enrolled into the tree or server.
- *DLTPND (Delete pending) indicates that the profile has been deleted on the AS/400 system but the profile has not been successfully deleted from the tree or server.
- RCYPND (Update recovery pending) indicates that the profile has changed on the AS/400 system but the updates have not been successfully enrolled into the tree or server. The system has encountered a recoverable error while trying to update the profile from the tree or server. The system will retry the update request.
- *DLTRCYPND (Delete recovery pending) indicates that the profile has been deleted on the AS/400 system but the profile has not been successfully deleted on the tree or server. The system has encountered a recoverable error while trying to delete the profile from the tree or server. The system will retry the delete request. If the error cannot be resolved, this entry can be removed by taking option 4 (Remove entry).

- *UPDFAIL (Update recovery failed) indicates that the profile has changed on the AS/400 system but the updates have not been successfully enrolled into the tree or server. The system has encountered a non-recoverable error while trying to update the profile on the tree or server. The system will not retry the update request. Once the error situation has been resolved, the update can be retried by issuing a CHGNWSUSRA command for the profile or by specifying option 6, Retry entry for the profile. If the error cannot be resolved, this entry can be removed by taking option 4 (Remove entry).
- *DLTFAIL (Delete recovery pending) indicates that the profile has been deleted on the AS/400 system but the profile has not been successfully deleted on the tree or server. The system has encountered a non-recoverable error while trying to delete the profile from the tree or server. The system will not retry the delete request. If the error cannot be resolved, this entry can be removed by taking option 4 (Remove entry).

Error Code:

The error code associated with the last attempt that was made to update or delete an OS/400 profile from the tree or server. Option 16 (Display error details) can be taken for the entry to display the message description associated with this error code. Use the Display Job (DSPJOB) command for the QNETWARE job to find the specific error message associated with this error code.

9.1.2 Work with NetWare Connections

The command shown in Figure 70 on page 116 allows you to work with active NetWare connections that originate from the AS/400 system. CGY(*LOCAL) was specified on the Work with NetWare Connection (WRKNTWCNN) command. To work with all connections on a NetWare server, specify CGY(*SERVER).

```
                  Work with NetWare Connections (WRKNTWCNN)

Type choices, press Enter.

Server . . . . . . . . . . . . . SERVER       > ITSONTW

Category . . . . . . . . . . . . CGY            *LOCAL
User profile . . . . . . . . . . USRPRF         *ALL

                                                                      Bottom
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
```

Figure 70. Working with NetWare Connections

Figure 71 on page 117 shows the output of the WRKNTWCNN command where *LOCAL was specified for parameter CGY. Only those NetWare connections originating from the AS/400 system are displayed.

```
                        Work with NetWare Connections
                                                              System:   SYSTEM10
Category . . . . . :   *LOCAL
User profile . . . . . :   *ALL

Type options, press Enter.
  4=End   5=Display   6=Print   8=Work with job

     Connection
Opt  number      Server        User        -------------Job--------------
       2         ITSONTW       POLSTER     QPADEV0003  POLSTER     310321
       7         ITSONTW       QNETWARE    QNETWARE    QSYS        309794
       10        ITSONTW       POLSTER     *ANY




                                                                       Bottom
Parameters or command
===>
F3=Exit      F4=Prompt   F5=Refresh   F6=Print list   F9=Retrieve   F10=Start
F12=Cancel   F17=Position to
```

Figure 71. Connections to NetWare, Originated on the AS/400 System

Figure 71 shows the output of the WRKNTWCNN command where *SERVER was specified for parameter CGY, specifying that connections to a particular NetWare server are displayed. All connections are displayed whether they originated from the AS/400 system or elsewhere on the network.

```
                        Work with NetWare Connections
                                                                 System:   SYSTEM10
Server . . . . . :   ITSONTW
Current context  . . . :   itsontw-org
Category . . . . . :   *SERVER

Type options, press Enter.
  4=End   5=Display   6=Print

                             Connection        Object
Opt    Object name           number             type     Time of last login
       ITSONTW                 1              *FILESRV    09.12.97  09:46:37
       POLSTER                 2                 *USER    09.12.97  18:12:00
       POLSTER                 3                 *USER    09.12.97  09:48:43
       POLSTER                 9                 *USER    09.12.97  18:12:01
       POLSTER                 10                *USER    09.12.97  18:29:53
       QNETWARE                7                 *USER    09.12.97  11:47:20
       QNETWARE                8                 *USER    09.12.97  11:47:20
                                                                          More...
Parameters or command
===>
F3=Exit   F4=Prompt   F5=Refresh   F6=Print list   F9=Retrieve   F12=Cancel
F17=Position to
```

Figure 72. NetWare Connections, Server Based

9.2 Server Administration

9.2.1 Working with Storage Spaces

9.2.1.1 Creating a Network Server Storage Space

Use the Create NWS Storage command shown in Figure 73 on page 119 to define an AS/400 object dedicated as object to be used by a network server.

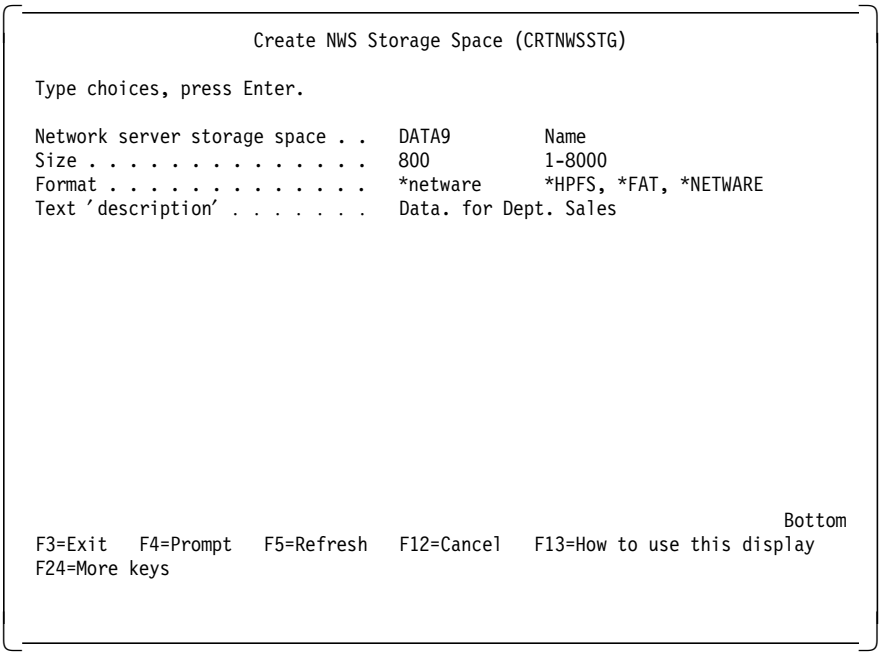


Figure 73. Creating a NetWork Server Storage Space

Important parameters for this command are:

- **NWSSTG:**

 The name of the storage space.

- **NWSSIZE:**

 The size of the storage space to be created. The size can range from 1 to 8000 megabytes. For *NETWARE, the minimum size is 2 megabytes.

- **Format:**

 The format to be used for the storage space. The format can be *HPFS (used by the LANSERVER/400 product), *FAT, or *NETWARE.

 In our case, we chose *NETWARE. The storage space is not formatted by the AS/400 system, but is partitioned and formatted by NetWare running on the Integrated PC Server. Storage spaces created with this format can be linked to network server descriptions of TYPE(*NETWARE) only.

9.2.1.2 Adding a Network Server Storage Space Link

The Add Network Server Storage Link (ADDNWSSTGL) command is used to add a network storage space link to a network server description. Up to 16 network server storage spaces can be linked to a network server

description at one time. In our example shown in Figure 74 on page 120, we link the storage space *DATA9* that we created previously using the CRTNWSSTG command to our Integrated PC Server based NetWare server ITSOIPCS.

```
                    Add Server Storage Link (ADDNWSSTGL)

Type choices, press Enter.

Network server storage space . . NWSSTG       > DATA9
Network server description . . . NWSD         > ITSONTWF
Access . . . . . . . . . . . . . ACCESS         *UPDATE

                                                                      Bottom
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
```

Figure 74. Adding Link for a Network Server Storage Space

Important parameters for this command are:

- **NWSSTG:**

 The name of the network server storage space.

- **NWSD:**

 The name of the network server description to which this link is to be added.

- **ACCESS:**

 How the server will access the storage space.

 – *UPDATE: The access is in READ/WRITE mode. Programs running on the server can write data on the storage space.

 – *READ: The access is in READ-only mode. Programs running on the server cannot write information on this storage space.

9.2.1.3 The Work with Network Server Storage Spaces Command

The Work with Network Server Storage Spaces display allows you to manage AS/400 storage space for your network servers. This display helps you list existing network server storage spaces and create new ones. You can also delete, display, print, link, and unlink existing storage spaces.

If a NetWare storage space is linked to multiple servers, there is one entry in the list for each server that storage space is linked to. Only the first entry for that storage space has the Name, Percent Used, and Size columns filled in; these columns are blank for any remaining entries for this storage space. Note that this only occurs for NetWare storage spaces (Format column is *NETWARE) that are linked as read-only (Access column is *READ).

```
                  Work with Network Server Storage Spaces
                                                              System:   SYSTEM10
Type options, press Enter.
  1=Create   4=Delete   5=Display   6=Print   10=Add link   11=Remove link

                 Percent
Opt  Name        Used     Size  Server      Drive    Format    Access

     AB510NTW       *     200  AB510NTW       8     *NETWARE  *UPDATE
     ANTW           *     200                       *NETWARE
     DATA10         *    2000  ITSOIPCS      10     *NETWARE  *READ
     DATA9          *     800  ITSOIPCS       9     *NETWARE  *UPDATE
     ITSOIPCS       *     200  ITSOIPCS       8     *NETWARE  *UPDATE
     ITSONTWF       *     200  ITSONTWF       8     *NETWARE  *UPDATE




                                                                        Bottom
Parameters or command
===>
F3=Exit   F4=Prompt   F5=Refresh   F6=Print list   F9=Retrieve
F11=Display text      F12=Cancel   F17=Position to
```

Figure 75. Working with Network Server Storage Spaces

The columns on this display have the following meaning:

- **Percent Used:**

 Displays the percentage of space being used for this network server storage space. If the server is varied off, the percentage displayed is the last percentage used. For storage spaces with a format of *NETWARE, the percent used information is only displayed if Enhanced NetWare Integration (option 25) is installed. Note that the percent used information for *NETWARE storage spaces is always initially displayed as an asterisk (*). This is done to reduce the time it takes to initially show the display. When F5=Refresh is pressed, the percent used

information for *NETWARE storage spaces is displayed. There are situations that prevent retrieving the percent used information for a *NETWARE storage space. An example of such a situation is when the server to which the storage space is linked cannot be contacted. If this happens, the percent used is displayed as an asterisk (*).

If a *NETWARE storage space is linked to multiple servers, the percent used information is displayed only once in this column.

- **Size:**

 Displays the size associated with this network server storage space. The possible values are from 1 to 8000MB. If the storage space is linked to multiple servers, the size of the space is displayed only once in this column.

- **Server:**

 The name of the network server description to which the network server storage space is currently linked. If the storage space is not linked, this column is blank.

- **Drive:**

 The drive associated with the network server storage space.

- **Format:**

 Displays the format of the network server storage space. *NETWARE storage spaces may be linked only to NetWare network servers. *HPFS storage spaces may be linked to LAN Server for OS/400 and base servers. *FAT (File Allocation Table format) storage spaces may be linked only to base servers.

- **Access:**

 Specifies whether or not the network server storage space is linked to the network server description with a read-only link (*READ) or with a read/write link (UPDATE).

9.2.2 Working with NetWare Volumes

The Enhanced Integration feature allows for creating, changing, and deleting NetWare volumes, as well as displaying or printing information about these objects.

9.2.2.1 Creating a NetWare Volume

The Create NetWare Volume (CRTNTWVOL) command creates a volume for the specified network server. The network server must be active at the time this command is run. The space is allocated from the device number (or a network server storage space can optionally be specified on a local system).

If the server is on the local system, the storage space must be linked to the network server description at the time this command is run.

A physical volume is created for the network server on the specified storage space.

For NetWare 4+, the volume object, which represents the physical volume, is automatically placed into the NetWare Directory Services (NDS) tree. The volume object is put into the same container as the server object which represents the network server.

The volume is mounted if specified.

```
                      Create NetWare Volume (CRTNTWVOL)

Type choices, press Enter.

Volume . . . . . .   itsontwdta
Server . . . . . > ITSONTW

Size of volume . . . . . .   *MAXAVAIL     *MAXAVAIL, 1-8000 megabytes
Device number  . . . . . .   0             0-99
Network server storage space . .           Name
Block size . . . . . .   *DFT          *DFT,4,8,16,32,64 kilobytes
Data compression . . . . . .   *YES          *YES, *NO
Block suballocation  . . . . . .   *YES          *YES, *NO
Mount  . . . . . .   *YES          *YES, *NO
Text . . . . . .   *VOL

                                                                    Bottom
F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
F24=More keys
```

Figure 76. Creating a NetWare Volume

Important parameters for this command are:

- **VOL:**

 The name of the new volume. This name must be unique within an NDS tree.

- **Server:**

 The server for the new volume. The server must be active at creation time.

- **Size:**

The size of the new volume. The dimension is in megabytes.

- **DEVNBR:**

 For remote servers, this parameter must be used rather than the NWSSTG parameter.

 For local servers, you can either specify a value from 0 to 99, pointing to the drive number for the network server storage space to be used.

- **NWSSTG:**

 The name of the network server storage space from which the storage for the volume is allocated. This storage space must be linked to the server specified by the NWSD parameter. This parameter can only be specified for the local system as this value is not known for remote servers.

 Note

 Either DEVNBR or NWSSTG parameter must be specified but not both.

- **BLKSIZE:**

 The block size of the data in the volume. This value cannot be changed once the volume is created. Volume blocks are the smallest piece of data the server can access in a volume. The larger the block size, the greater the potential for wasted memory. However, if the majority of files are large, a large block size may be more efficient. Turning on block sub-allocation will aid in minimizing waste. Block sub-allocation is specified with the BLKSUBALC parameter. The shipped default for block sub-allocation is *YES.

 – *DFT: Specifies using the block size that NetWare determines by default given the size of the volume.

 – Specify the block size of the data in the kilo-bytes. Valid values are: 4, 8, 16, 32, and 64.

- **DTACPR:**

 Specifies whether or not to enable data compression for this volume Note that once data compression is turned on for a volume, it cannot be turned off.

- **BLKSUBALC**

 Specifies whether or not to enable block sub-allocation for this volume. Note that once block sub-allocation is turned on for a volume, it cannot be turned off.

- **MOUNT**

 Specifies whether or not to mount this volume as soon as it is created. Do not mount volumes that are rarely used because each mounted volume uses some server memory. Volumes can be mounted and dismounted while the server is active.

9.2.2.2 The Work with NetWare Volumes Command

This display allows you to work with the volumes for a NetWare server. You can use this display to create, change, delete, display, and print volumes.

```
                          Work with NetWare Volumes
                                                              System:   SYSTEM1O
Server . . . . . . . . :   ITSONTW

Type options, press Enter.
  1=Create   2=Change   4=Delete   5=Display   6=Print

                               Percent
Opt  Volume             Size   Used    Mounted  Text

     ITSONTWDTA          160        0   *YES    itsontwdta
     SYS                 150       35   *YES    SYS









                                                                        Bottom
Parameters or command
===>
F3=Exit   F4=Prompt   F5=Refresh   F6=Print list   F9=Retrieve   F12=Cancel
```

Figure 77. Working with NetWare Volumes

The columns on this display have the following meaning:

- **Volume:**

 The physical name of the NetWare volume.

- **Size:**

 The size of the volume in megabytes.

- **Percent Used:**

 Displays the percentage of space used for this NetWare Volume space. If an asterisk (*) is displayed, the volume is not mounted and the system cannot report the percent of volume space used on a dismounted volume. If a double asterisk (**) is displayed, the percent of the volume

space being used is unknown. The reason is that NetWare cannot accurately report the value because the number of blocks is greater than 64 kilo-bytes.

- **Mounted:**

 Indicates if the volume is mounted to the server.

Chapter 10. Printing Integration

The Enhanced NetWare Integration for OS/400 supports the AS/400 system to NetWare or Host to LAN printing function that provides the ability to route AS/400 printed output to a printer queue controlled by a NetWare server. This function can take advantage of OS/400 host print transform to translate the print data stream. Common target PC printers can be specified on the output queue.

On the AS/400 system, an output queue is configured pointing to the target NetWare print queue and within the respective NDS context or server. A remote printer writer is started that allows print output from properly authenticated users to be sent to the NetWare print queue. On the NetWare server, no special configuration is required.

Each AS/400 user sending print output to the NetWare server must be properly authenticated. For each entry on the output queue, the user profile is checked for a connection to the NetWare server and, if not connected, the user's authentication entry is used to make a connection. A connection to the server can also be started manually using the STRNTWCNN command. Specify *ANY on the **AUTJOB** parameter to allow print jobs to use the existing connection.

Figure 78 on page 128 illustrates the environment we used in our testing. The PC NetWare Server ITSONTW acts as the NetWare server. A laser printer IBM4019 is attached to this server.

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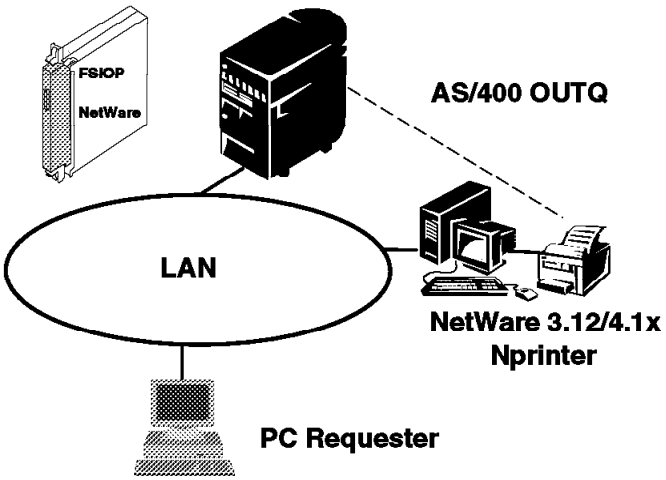


Figure 78. Host-to-LAN Printing

10.1 Setup Steps

Using a 5250 display for the AS/400 related tasks:

1. Create an output queue pointing to the NetWare attached printer.
2. Use the STRRMTWTR command to start the connection.

Use the NetWare Administrator tool to add objects to NDS:

1. Create a print queue object in NetWare.
2. Create a printer object in NetWare.
3. Create a print server object in NetWare.

Using the NetWare Remote Console tool:

1. Load the PSERVER module.
2. In case there is only a IPCS based server: Load the NPRINTER module to address a printer attached to a PC Requester.

10.1.1 AS/400 Tasks

It is fairly simple to reroute AS/400 print output to a NetWare based printer. All you have to do is to create an output queue on in OS/400 and to start a remote writer using that output queue.

- Create an output queue on the AS/400 system by using the CRTOUTQ command. Press F4 for prompt.

```
                        Create Output Queue (CRTOUTQ)

Type choices, press Enter.

Output queue . . . . . . . . . . OUTQ         > NTWQUEUE
  Library  . . . . . . . . . . .              >   POLSTER
Maximum spooled file size:       MAXPAGES
  Number of pages  . . . . . . .                *NONE
  Starting time  . . . . . . . .
  Ending time  . . . . . . . . .
                          + for more values
Order of files on queue  . . . . SEQ            *FIFO
Remote system  . . . . . . . . . RMTSYS       > *NWSA



Remote printer queue . . . . . . RMTPRTQ      > NTWQUEUE



                                                                      More...
F3=Exit   F4=Prompt   F5=Refresh   F10=Additional parameters   F12=Cancel
F13=How to use this display        F24=More keys
```

Figure 79. Create Output Queue on the AS/400 System (Display 1)

Important parameters on this screen are:

- **RMTSYS:**

 We have to specify *NWSA here, in combination with *NDS for the DESTTYPE parameter. Used to identiy the remote print queue in the STRRMTWTR command.

- **RMTPRTQ:**

 Enter the name of a valid print queue in NetWare. This is the queue to be assigned to the NetWare print server you start with the PSERVER NLM.

```
                        Create Output Queue (CRTOUTQ)

Type choices, press Enter.

Writers to autostart . . . . . AUTOSTRWTR     *NONE
Queue for writer messages  . . . MSGQ          QSYSOPR
  Library  . . . . . .                           *LIBL
Connection type  . . . . . . . . CNNTYPE      > *IPX
Destination type . . . . . . . . DESTTYPE     > *NDS
Host print transform . . . . . . TRANSFORM      *YES
Manufacturer type and model  . . MFRTYPMDL    > *IBM4019
Workstation customizing object   WSCST         *NONE
  Library  . . . . . .
Destination options  . . . . . . DESTOPT        *NONE


User defined option  . . . . . . USRDFNOPT      *NONE
                          + for more values


                                                                      More...
F3=Exit   F4=Prompt   F5=Refresh   F10=Additional parameters   F12=Cancel
F13=How to use this display        F24=More keys
```

Figure 80. Create Out Queue on AS/400 System (Display 2)

Important parameters on this screen are:

- **CNNTYPE:**

 We use *IPX here, to specify, that the files have to be sent using the IPX protocol.

- **DESTTYPE:**

 The type of the remote system as specified in the RMTSYS parameter. Since we route print output to a NetWare based queue, we can enter:

 - *NETWARE3: The spooled files are to be sent to NETWARE3. Valid only for CNNTYPE *IPX or *USRDFN.
 - *NDS: The spooled files are to be sent to an NDS print queue. Valid only for CNNTYPE *IPX or *USRDFN.

- **TRANSFORM**

 We have the opportunity to make use of the host print transform function to have the AS/400 transform a spooled file type *SCS into ASCII data when the file is sent to the NetWare based printer.

- **MFRTYPMDL:**

We can enter an exact printer model as used for the NetWare printer, when we use the host print transform function This parameter is only prompted when TRANSFORM(*YES) is specified or a user data transform program is specified.

The remote output queue, NTWQUEUE, is created.

- Enter the Start Remote Writer (STRRMTWTR) command:

  ```
  STRRMTWTR OUTQ(POLSTER/NTWQUEUE)
  ```

Now you can send spooled files to this printer queue.

10.1.2 NetWare Tasks

For readers with a stronger AS/400 than NetWare background we show some setup steps for printing in NetWare in this section.

Use the NWADMIN tool to set up print queue QNETWARE in NDS. Click on the container object you want to use. In our example, we chose the NDS organization *itsontw-org* as the location for the print queue. Switch to the menu bar and click **Object** and **Create**. On the **New object** window, select the **Print queue** shown in Figure 81 on page 132.

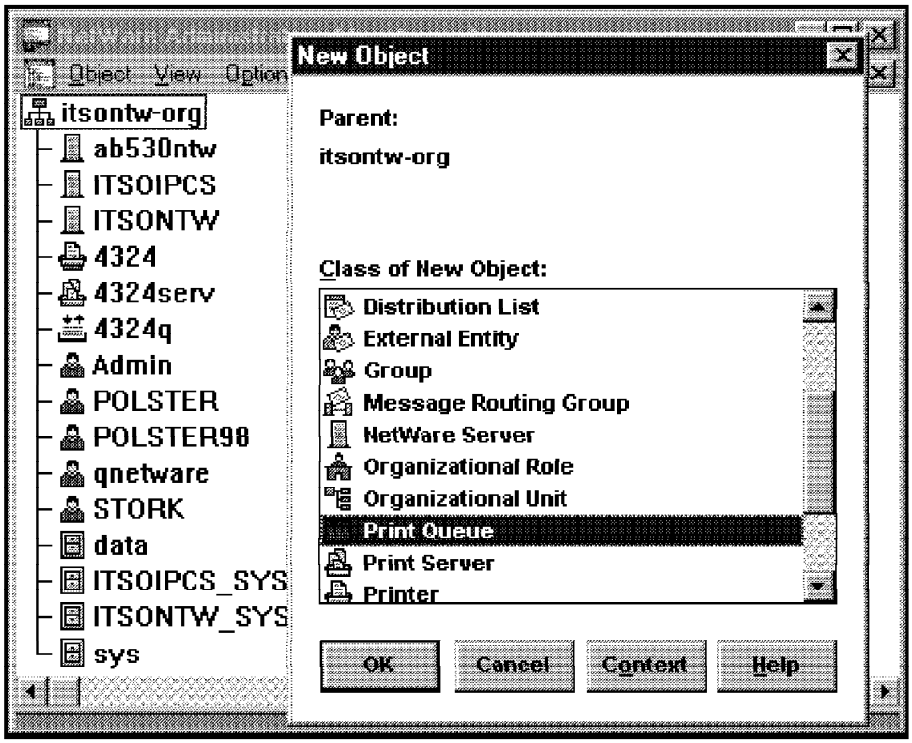


Figure 81. Starting to Configure Print Integration

In the **Create Print Queue** window, enter the name of your print queue into field *Print Queue Name*. We chose to call our print queue **ntwprtq**.

You also have to specify a NetWare volume to hold the print queue. In our example, we chose the SYS: volume of our server and entered fully-qualified **ITSONTW_SYS.itsontw-org** as shown in Figure 82 on page 133. Click on **Create** to create the print queue.

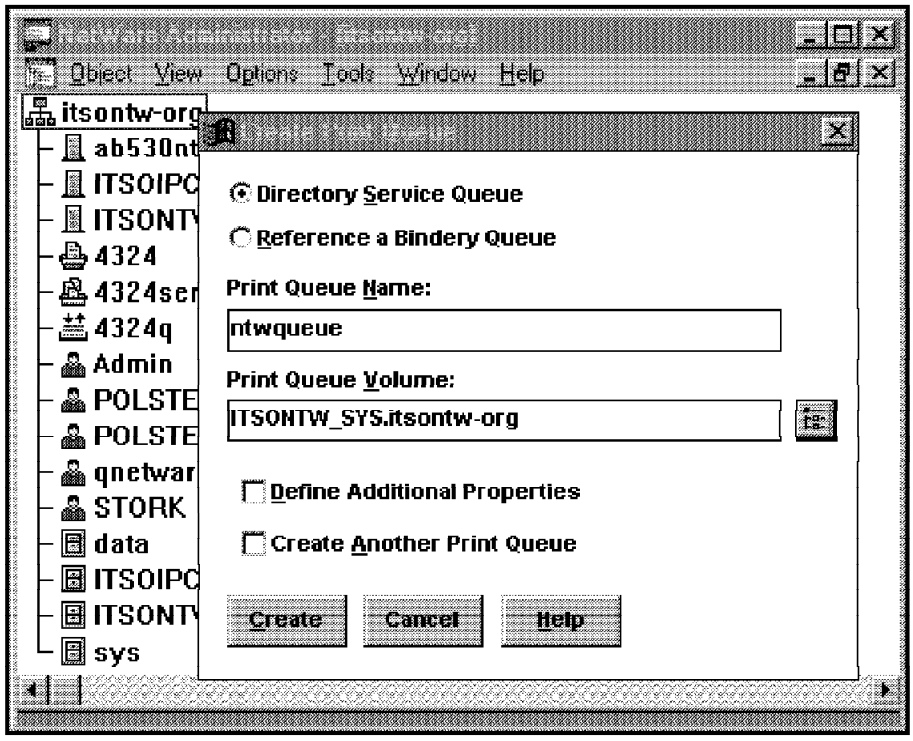


Figure 82. Creating a Print Queue in NetWare Administrator

The next step is to create a printer object in NDS.

Again, highlight the NDS container object where you want to create the printer object. Switch to the menu bar and click **Object** and **Create**. From the **New Object** window, select **Printer**. In the **Create Printer** window, enter the name of the printer (in our case, **ntwprt**). Also, check the **Define Additional Properties** box shown in Figure 83 on page 134.

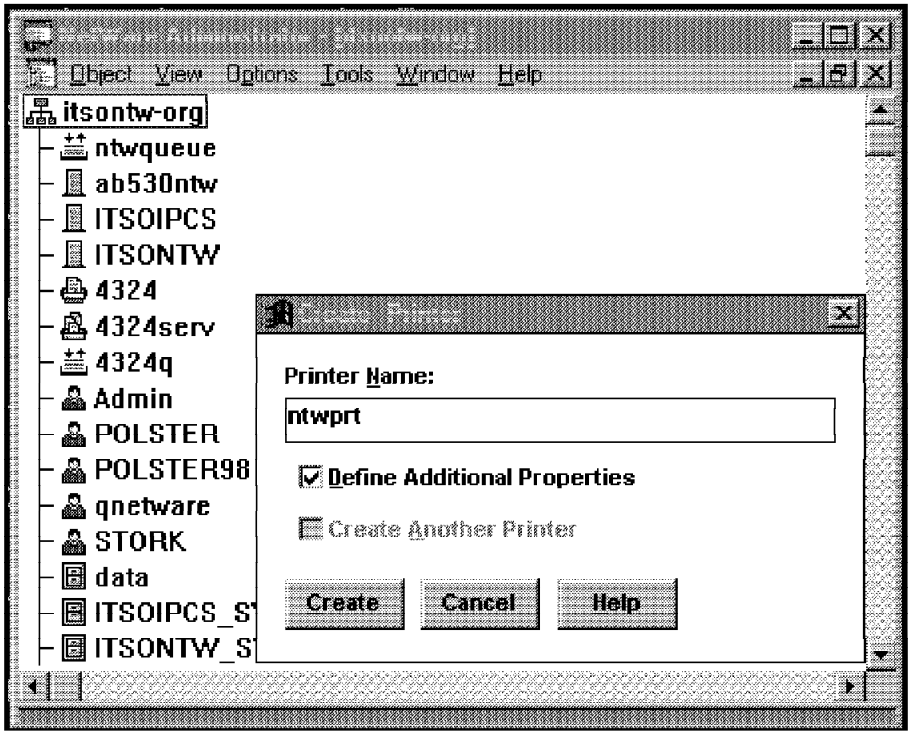


Figure 83. Creating a Printer Object in NetWare Administrator

The **Printer : ntwprt** window is shown. Click on the **Assignment** button on the right-hand side to open the Assignments dialog. Click on the **Add** button. The **Select Object** window is shown. There, select the print queue you want to assign and click the **OK** button. The result looks similar to our example in Figure 84 on page 135.

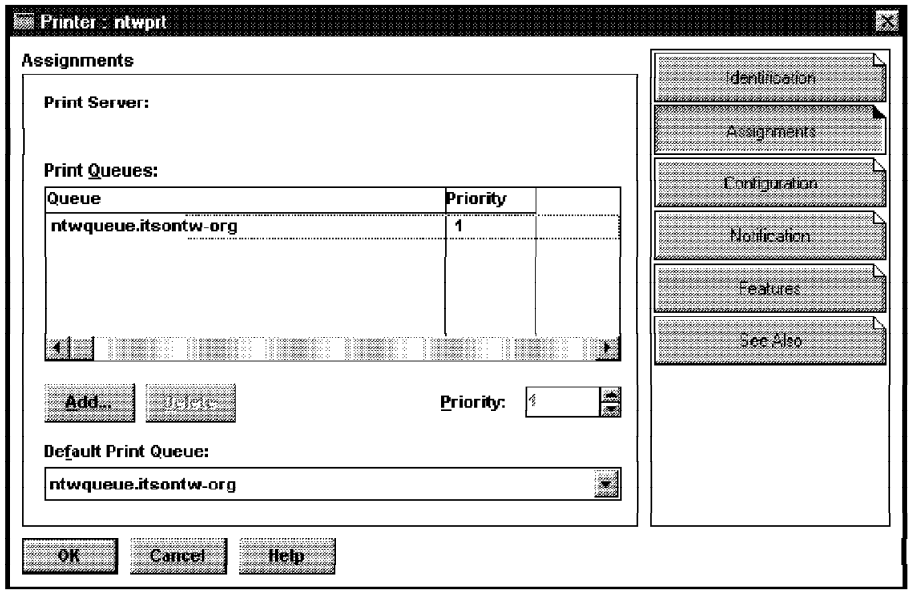


Figure 84. Attaching the Print Queue to the Printer

The next step is to create a Print Server object in NDS.

Again, highlight the NDS container object where you want to create the print server object. Switch to the menu bar and click **Object** and **Create**. From the **New Object** window, select **Print Server**. In the **Create Print Server** window, enter the name of the print server in the **Print Server Name** field (in our case *ntwprtsvr*) and check the **Define Additional Properties** box shown in Figure 85 on page 136.

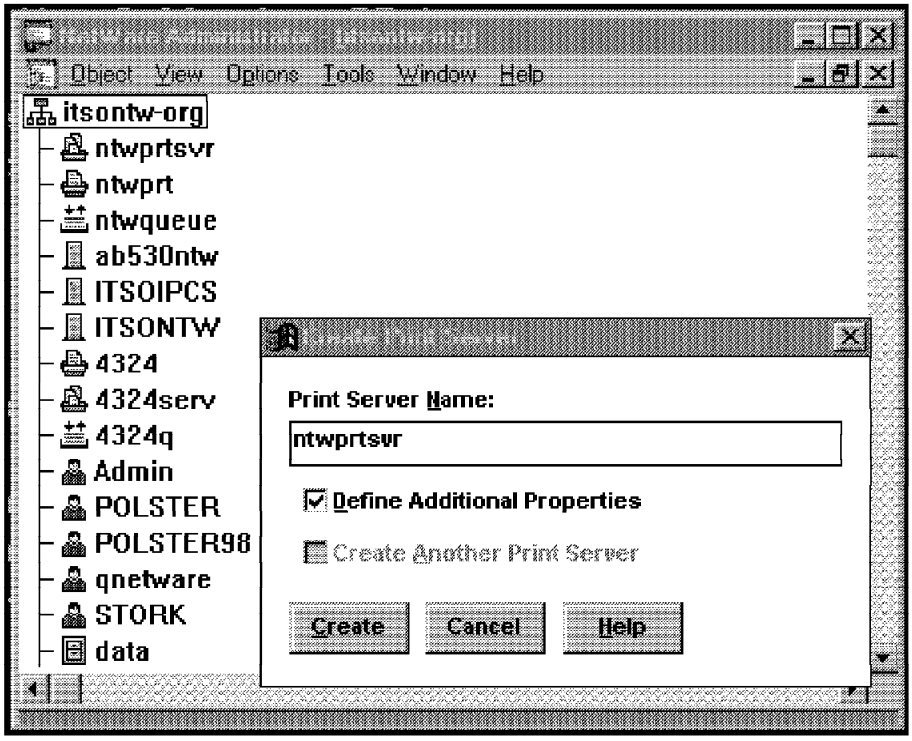


Figure 85. Creating a Print Server Object in NetWare Administrator

The **Print Server : ntwprtsrv** window is shown. Click on the **Assignment** button on the right-hand side to open the Assignments dialog. Click on the **Add** button. The **Select Object** window is shown. There, select the print server you want to assign and click the **OK** button. The result looks similar to our example in Figure 86 on page 137.

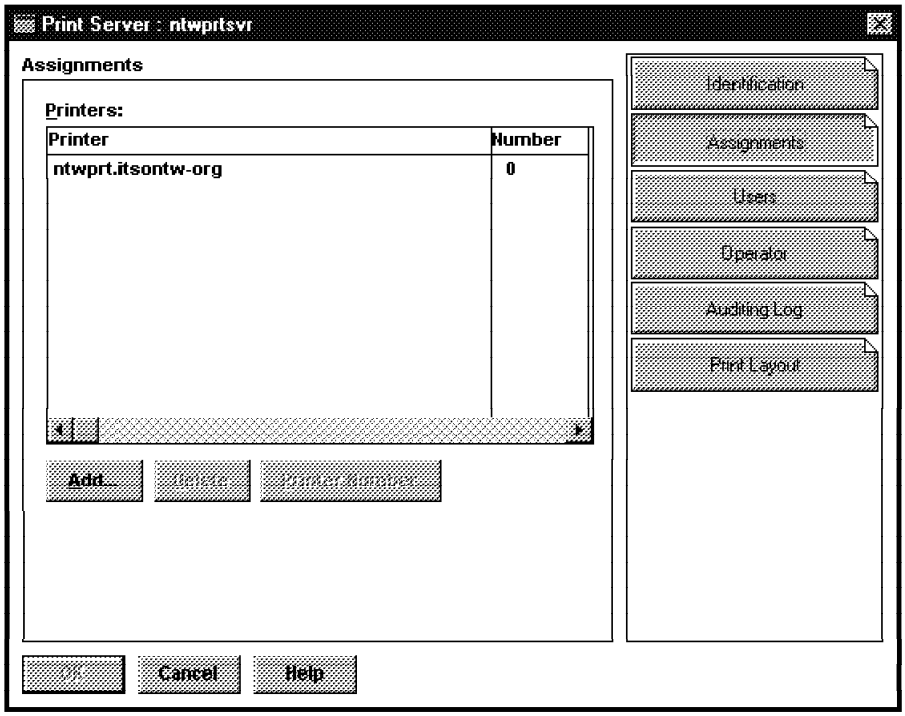


Figure 86. Attaching the Printer to the Print Server

To activate the print environment we just created, we switch to the NetWare RCONSOLE utility.

Type **Load PSERVER** to start the PSERVER NLM on the NetWare server. The **Enter print server name** dialog is started as shown in Figure 87 on page 138.

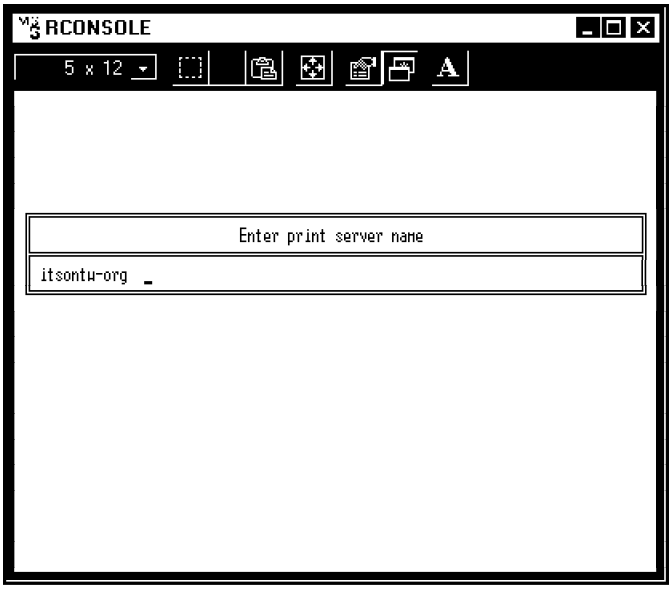


Figure 87. Loading the PSERVER Module

Press the Enter key to navigate through the NDS hierarchy and select your print server within the **Contents of current context** dialog box by highlighting the print server object and pressing the Enter key again (see Figure 88 on page 139).

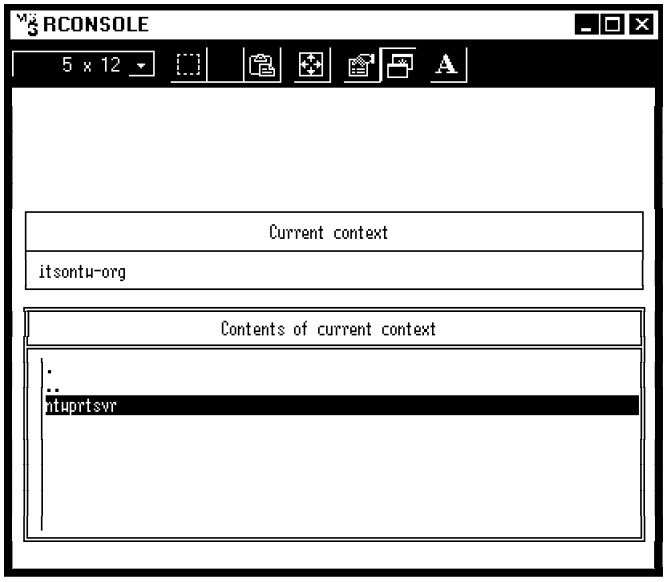


Figure 88. Selecting a Print Server

In case the printer is not attached to the server but to a Requester, as is the case when you use an IPCS based server:

Use the System Console interface of the RCONSOLE utility and load the NPRINTER NLM, specifying the print server and the actual printer number. For example you can use:

```
Load nprinter ntwprtsvr 0
```

The printer console is shown in Figure 89 on page 140.

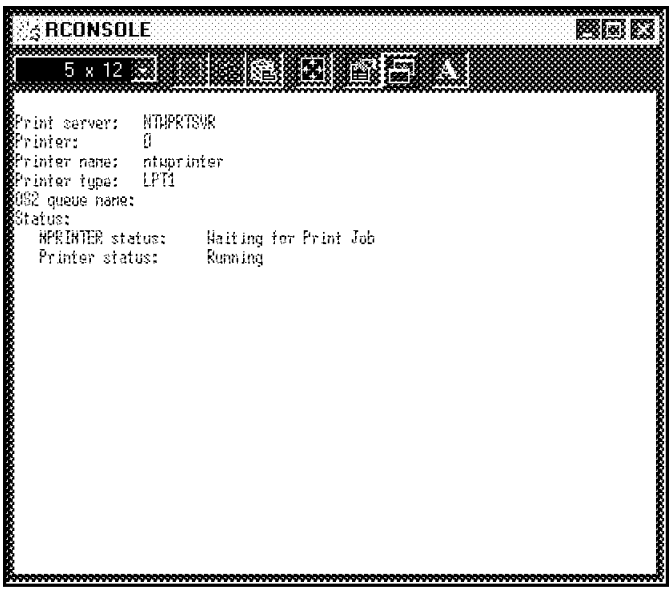


Figure 89. The NPRINTER Utility

Chapter 11. File System Integration

The AS/400 Integrated File System (IFS) provides for the opportunity to run different file systems on the AS/400 system at the same time and takes advantage of the many possibilities the different file systems offer. With the Enhanced Integration feature, files from NetWare based environments are (as file system QNetWare) part of the IFS, independent of their physical location. They can reside within AS/400 storage spaces or on NetWare servers in the LAN. Table 10 shows different file systems that you can access by the common interface of IFS.

Table 10. File Systems in AS/400 IFS

File System Name	Functions
/root	Hierarchical directory structure of the IFS
QOpenSys	The open systems file system
QSYS.LIB	Library File System
QDLS	The Document Library Services File System
QNetWare	The NetWare File System
QLANSrv	The LAN Server File System
QOPT	The Optical File System
NFS	The Network File System
UDFS	The User-Defined File System

The QNetWare file system provides access to NetWare files, directories, and NetWare Directory Services (NDS) objects through the AS/400 Integrated File System (IFS). The NetWare servers can be 3.12 or 4.1x. The file system is used primarily by AS/400 programs and utilities and Client Access/400 users through the network drives support.

AS/400 applications can be written using the IFS APIs to access stream file data on a NetWare Server. An AS/400 file can be copied to or from a file on the NetWare server with the OS/400 commands that copy to or from a stream file.

Mapping NetWare security to AS/400 security occurs when the file system is used from AS/400 commands or through the Client Access/400 network drives functions.

This chapter describes how you can access NetWare files system from the AS/400 system and Client Access/400 by using the QNetWare file system.

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11.1 The QNetWare File System Architecture

You can use the QNetWare file system to:

- Access data stored on a local or remote Integrated PC Server running Novell NetWare 4.1x.
- Access data stored on PC servers running Novell NetWare 3.12 or 4.10. You can access data on these servers and Integrated PC Servers simultaneously by using authentication entries.
- Access NetWare Directory Services (NDS) objects.
- Dynamically mount NetWare file systems over any local mountable file system. Flexible mount options similar to the *MAP* command simplify and accelerate access to NetWare files.
- Store data in stream files.

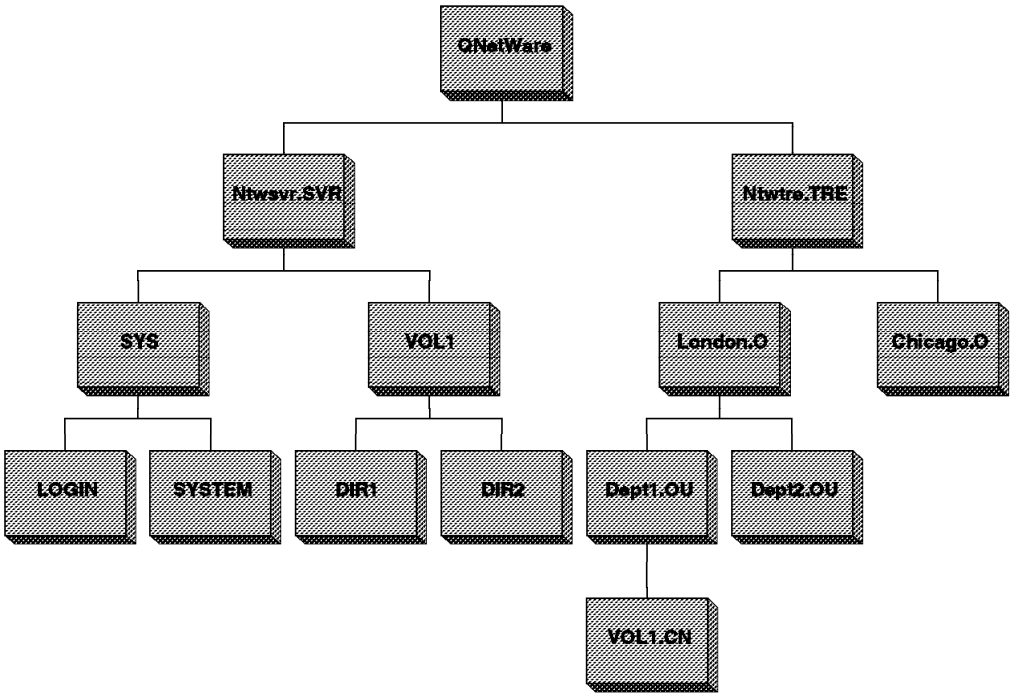


Figure 90. QNetWare File System Architecture

```
                          Work with Object Links

Directory  . . . . :   /QNetWare

Type options, press Enter.
  3=Copy   4=Remove   5=Next level   7=Rename   8=Display attributes
  11=Change current directory ...

Opt   Object link            Type     Attribute    Text
      ABAS400TREE.TRE        DDIR
      AB53ONTW.SVR           DDIR
      ITSONTW-TREE.TRE       DDIR     Top
      ITSONTWF.SVR           DDIR
      SAV.RST                DDIR




                                                                      Bottom
Parameters or command
===>
F3=Exit   F4=Prompt   F5=Refresh   F9=Retrieve   F12=Cancel   F17=Position to
F22=Display entire field           F23=More options
```

Figure 91. The WRKLNK Command Displaying the QNetWare File System

Beginning with Novell NetWare 4.1, a new concept (NetWare Directory Services (NDS)) was introduced providing better flexibility and ease-of-use for NetWare users. NDS is a distributed database that provides for access to all resources on different NetWare servers according to the user's access rights. For more information about NDS, refer to Chapter 3, "Novell NetWare Directory Services" on page 31.

In Figure 90 on page 142, the extension *.SVR* is used to represent a Novell NetWare server. The volumes under servers can be mounted to the VOLUME directory under */QNETWARE*.

The extension *.TRE*, *.C*, *.O*, *.OU*, and *.CN* are used to represent NDS trees, countries, organizations, organization units, and common names respectively. If a Novell NetWare volume is accessed through the NDS path through a volume object, its root directory is also automatically mounted on the NDS object.

The QNetWare File System is similar to other file systems; it uses directories and sub-directories to store data. This data can be accessed by CA/400 and AS/400 users.

AS/400 users use Integrated File System commands and menus to access QNetWare File System. Usually, for convenience, we mount the subdirectory of QNETWARE to other file systems. Otherwise, you have to

step through file system QNETWARE to find a specific file. Here is an example of how to mount QNETWARE directories over other file systems.

1. Create IFS directory NTW01 using the following AS/400 command:

   ```
   MD DIR(NTW01)
   ```

2. Mount the volume ITSONTWDTA over the subdirectory you just created, NTW01:

```
                              Add Mounted FS (MOUNT)

Type choices, press Enter.

Type of file system  . . . . . > *NETWARE      *NFS, *UDFS, *NETWARE
File system to mount . . . . . > 'ITSONTW_ITSONTWDTA'

Directory to mount over  . . . . > 'NTW01

Mount options  . . . . . .   'rw,acregmax=60,acdirmax=60'



                                                                  Bottom
F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys
```

Figure 92. Mount NetWare Directory to Other File Systems

3. You can use the AS/400 WRKLNK command to verify your work. Type at an OS/400 command line:

   ```
   WRKLNK NTW01
   ```

 Then choose option 5, **Next level** The result will look similar to our example in Figure 93 on page 145.

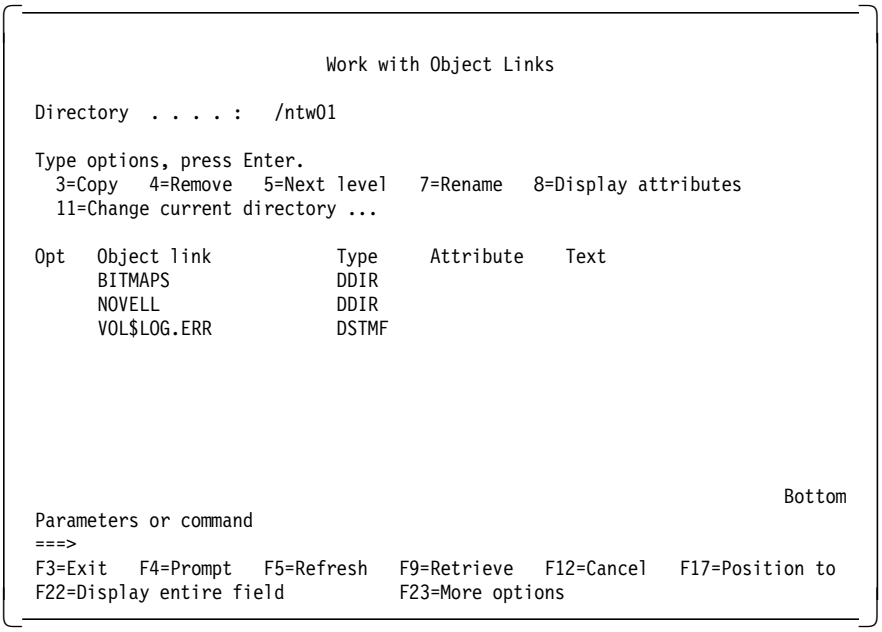


Figure 93. The WRKLNK command to display mounted file system NTW01

You can also use Client Access for Windows or Client Access Optimized for OS/2 to access the IFS. NetWare files will also be accessible to clients without the NetWare rewuester installed.

Part 4. Special Topics

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Chapter 12. Backup/Restore Options

The OS/400 Integration for Novell NetWare now offers a wide variety of backup/restore options for data stored on Novell NetWare servers, including the Integrated PC Server. Therefore, there is no ″right″ way of saving/restoring data in this environment. It depends on the requirements you have.

This chapter gives an overview of the different save/restore techniques available and their strengths and weaknesses. It also shows the prerequisites for the different options.

12.1 Overview

In an OS/400 Integration for Novell NetWare environment without the OS/400 Enhanced Integration for Novell NetWare feature implemented and where the data is stored on a storage space controlled by an Integrated PC Server, the following save/restore options are available:

- Save/restore the NWS storage space (in directory QFPNWSSTG) using OS/400 SAV/RST commands. Only data on an Integrated PC Server can be saved/restored on the same AS/400 system where the Integrated PC Server is installed.
- Save/restore the data from the Integrated PC Server and possibly from other servers in the network using the ″Novell NetWare tape Support for OS/400″, the so-called ″tape pipe″. The data is saved using Novell NetWare software such as SBACKUP or Cheyenne ARCserve. AS/400 tape drives are used to store the data.
- Save/restore the data from the Integrated PC Server and possibly from other servers in the network. The data is saved on tape drives **not** attached to the AS/400 system. The software used for the save/restore is Novell NetWare software such as SBACKUP and Cheyenne ARCserve.

In an OS/400 Integration for Novell NetWare environment with the OS/400 Enhanced Integration for Novell NetWare feature installed, the following save/restore option is available in addition to the options previously mentioned:

- Save/restore the data from the Integrated PC Server and possibly from other servers in the network using the SAV/RST CL commands for the IFS directory QNetWare available with the OS/400 Enhanced Integration for Novell NetWare feature. AS/400 tape drives are used to store the data.

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Let's have a look at all the possibilities and their characteristics as well as their requirements.

12.2 Save/Restore NWS Storage Space

This is the "basic" method to save data from the Integrated PC Server to AS/400 save media. It is totally AS/400 system controlled; no Novell NetWare involvement is required. In fact, this method works independent from the server type installed on the Integrated PC Server (whether it is Novell NetWare, LANSERVER/400, or Lotus notes). The save/restore operation begins at the QFPNWSSTG directory path of the IFS. In this environment, the entire storage space is only one big object for OS/400; OS/400 is not aware of the objects within the storage space (Novell NetWare objects such as files, programs, and so on). The save operation is done using the following command:

```
                              Save Object (SAV)

Type choices, press Enter.

Device . . . . . . . . . . . . . DEV          > 'QSYS.LIB/TAP01.DEVD'

                           + for more values

Objects:                            OBJ
  Name . . . . . . . . . . . . .               > 'QFPNWSSTG/ITSCNTWF'

  Include or omit  . . . . . . .                 *INCLUDE
                           + for more values
Directory subtree  . . . . . . . SUBTREE        *ALL
Save active  . . . . . . . . . . SAVACT         *NO
Output . . . . . . . . . . . . . OUTPUT         *NONE
```

Figure 94. SAV Command to Save NWS Storage Space

The storage space can be saved to any OS/400 save medium such as a save file.

Let's have a look at the advantages/disadvantages of this method.

Characteristics are:

- No additional software is needed; OS/400 (57xx-SS1) and 57xx-SA2 are all that is needed.
- The method is relatively fast; the speed depends on the speed of the tape drive.

- Since it is all done using ″normal″ OS/400 saving methods, the backup of Integrated PC Server data can be integrated into the AS/400 backup jobs you already have in place. This is especially advantageous when you run the backup as a nightly, unattended job as many AS/400 customers do.
- Only data from Integrated PC Servers installed on the same AS/400 system that the SAV command runs on can be saved. Data on other servers must be saved using different techniques.
- The network server description whose storage is going to be saved must be varied off before the save operation can be started. All users of the Novell NetWare on that Integrated PC Server must, therefore, log out before saving the storage space becomes possible.
- Since OS/400 only ″sees″ the NWS storage space as one single object, the SAV command saves the entire storage space. This is true even if, from a Novell NetWare point of view, the volume (or volumes) on this storage space are more or less empty. This takes time and tape space (even when compressing the data on tape).
- The most severe disadvantage is, again, because OS/400 ″sees″ the entire storage space as a single object. Not being aware of what actually is **in** it, the restore operation correspondingly can only restore the **entire** storage space. That means that you cannot restore single Novell NetWare objects such as files to the Integrated PC Server when using this backup/restore method.

12.3 Save/Restore Data to AS/400 Tape Using ″Tape Pipe″

This backup method is taking advantage of a new feature in V3R7, which is available as of February 1997. Tape pipe is implemented as part of the program products 5716-SA2, 5716-SA3, and the base operating system. This tape pipe support requires an Integrated PC Server to run on.

12.3.1 What is Tape Pipe Support?

In one sentence, tape pipe means that AS/400 tape drives are integrated into a Novell NetWare network.

The function allows Novell NetWare backup/restore software to actually use AS/400 tape drives to store the data on.

In this environment, a tape drive of an AS/400 system is used, but the actual operation of the backup/restore process is done from a Novell NetWare environment. Actually, from an OS/400 point of view, the tape drive used for the Novell NetWare backup/restore operation is in a state of varied off.

For the Novell NetWare, the AS/400 tape drive presents itself as an SCSI tape drive. The two Novell NetWare backup/restore program packages IBM has tested in this environment are:

- SBACKUP, Novell's own package
- ARCserve 6 from Cheyenne

Any other backup/restore software supporting SCSI attached tape drives under Novell NetWare might work; it is up to the user to test this. IBM only supports problems found using SBACKUP or ARCerve 6.

Characteristics of this support are:

- Existing AS/400 tape drives can be used for Novell NetWare backup.
- Existing Novell NetWare backup software can be used to back up to an AS/400 tape. SBACKUP and Cheyenne ARCserve certify certain AS/400 tape drives; other software might work.
- The tape pipe support runs only on an Integrated PC Server.
- Although tape pipe support requires an Integrated PC Server to run on, Novell NetWare data from any Novell NetWare 4.11, Novell NetWare 4.x, or Novell NetWare 3.12 server can be backed up/restored.
- Backup runs fast, especially using fast tape drives such as an IBM 3590.
- The following AS/400 tape drives were completely tested and are certified by Novell and Cheyenne.
 - 6380 (1/4″ cartridge)
 - 6390 (8mm cartridge)
 - 3590 (1/2″ cartridge)

 Other tape drives of the same type (1/4″ and 8mm tape cartridge drives) may work; in fact, during our test we were using an IBM 6379 1/4″ cartridge drive and it worked fine.
- The following drives do not work with the ″Tape-Pipe″ support:
 - 1/2-inch reel tape drives (2440, 3422, 3430, 9347, 9348)
 - 1/2-inch cartridge tape drives (3480/3490/3490e)
- Before the AS/400 tape drive can be used by the Novell NetWare backup/restore software, the device must be varied off on the AS/400 system.

- The IBM 3590 tape drive must be switched to ″manual operation″ so the automatic transition from one magazine slot to the next one is not possible.
- The tapes cannot be shared between OS/400 and Novell NetWare. A tape containing AS/400 data cannot be used by Novell NetWare without being initialized first. It must be initialized with the following parameters:

  ```
  INZTAP  TAPxx CHECK(*NO) DENSITY(*CTGTYPE)
  ```

 That means that it must be initialized with the parameter value NEWVOL(*NONE) while tapes to be used with OS/400 are initialized with a NEWVOL parameter other than *NONE.
- The previously mentioned characteristics (separate tapes, backup in varied off mode, manual mode with IBM 3590) make it nearly impossible to integrate the Novell NetWare backup procedures into existing AS/400 backup procedures since the AS/400 procedures usually run in an unattended night batch job. The Novell NetWare backup job does not fit in there. However, you can automate the Novell backups if the backup data fits on one tape. This must be done independently from AS/400 backups.
- The tape pipe support only exists for OS/400 V3R7.
- In a more AS/400 oriented environment, the Novell NetWare backup software requires additional skill, administrative as well as operational.
- A maximum of one AS/400 tape drive can be allocated to Novell NetWare at any given point in time.

12.3.2 How Does Tape Pipe Work?

The tape pipe support consists of several modules, some running on the AS/400 system and some running on the Novell NetWare on the Integrated PC Server. There is no Novell NetWare installation process necessary; the Novell NetWare modules are on the F: drive (where they can be loaded from). You only need to load and apply the needed PTFs to get the support.

12.3.3 Activating the Tape Pipe Support

To activate the tape pipe support you can use the RCONSOLE support of Novell NetWare. Using RCONSOLE, log in to the Integrated PC Server and enter the following NetWare Console commands:

- LOAD AS400TP.HAM

 This command loads the Novell NetWare module (or modules) provided by IBM for the tape pipe support. You can now communicate with this module by entering the following commands:

– AS400TP LIST

 This command lists all of the existing AS/400 tape drives on the AS/400 system where the Integrated PC Server is installed. You see something similar to this:

```
0)  TAP01        6379  001
1)  TAP02        6390  001
```

 From this list, you can select the tape drive you want to use by entering the next command:

– AS400TP ALC 1

 This command allocates the tape drive with the number 0 (the 6379 tape drive) to Novell NetWare. For this operation to succeed, the tape drive must be varied off in OS/400. Otherwise the operation fails. As long as the tape drive is allocated to Novell NetWare, vary on attempts in OS/400 will fail.

 Although the tape drive is now allocated to Novell NetWare, it is not yet available to Novell NetWare backup software. To make it available, you must enter the following command:

– LIST DEVICES

 You now get a list of available devices similar to this:

```
ITSCNTWF:
ITSCNTWF:list devices
 1. Device #  0 QFPSVRSTG  (A3000000).
 2. Device #  1 QFPSVRSTG  (A3000100).
 3. Device #  2 QFPSVRSTG  (A3000200).
 4. Device #  3 QFPSVRSTG  (A3000300).
 5. Device #  4 QFPSVRSTG  (A3000400).
 6. Device #  5 QFPSVRSTG  (A3000500).
 7. Device #  6 QFPSVRSTG  (A3000600).
 8. Device #  7 QFPSVRSTG  (A3000700).
 9. Device #  8 ITSCNTWF   (A3000800).
31. [V2D0-A0-D0:0] IBM_6379.
ITSCNTWF:
```

Figure 95. LIST DEVICES Output

 When you see the AS/400 tape drive show up in the list, you can run the Novell NetWare backup software with the AS/400 tape drive. When you are finished using the AS/400 tape drive from Novell NetWare, you can make the drive available to OS/400 by entering:

– AS400TP DLC 0

 This command de-allocates the tape drive from Novell NetWare and makes it available to OS/400 again. You can now vary on the tape drive again.

You can switch the tape drive back and forth between OS/400 and Novell NetWare as often as you want. Do not forget to switch the tape cartridge also, since OS/400 and Novell NetWare cannot share the tape cartridge.

12.3.4 Using the Tape Pipe with SBACKUP

Before using SBACKUP with the tape pipe support, make sure that you have the latest version of the SBACKUP fixes installed on the Integrated PC Server. As of February 1997, the latest fix package is SBACK6.EXE.

Once you have made the AS/400 tape drive available to Novell NetWare as previously described, you can start loading the backup/restore software you want to use. The statements you have to enter differ depending on the software product you are using. For SBACKUP, enter the following statements from the RCONSOLE session:

- LOAD TSA410 or TSANDS for saving NDS objects:

 This statement loads the Novell NetWare Target Service Agent NLM.

- LOAD SBACKUP:

 This statement loads the SBACKUP utility NLM.

After loading these modules, you have to do the SBACKUP device allocation as shown in Figure 96.

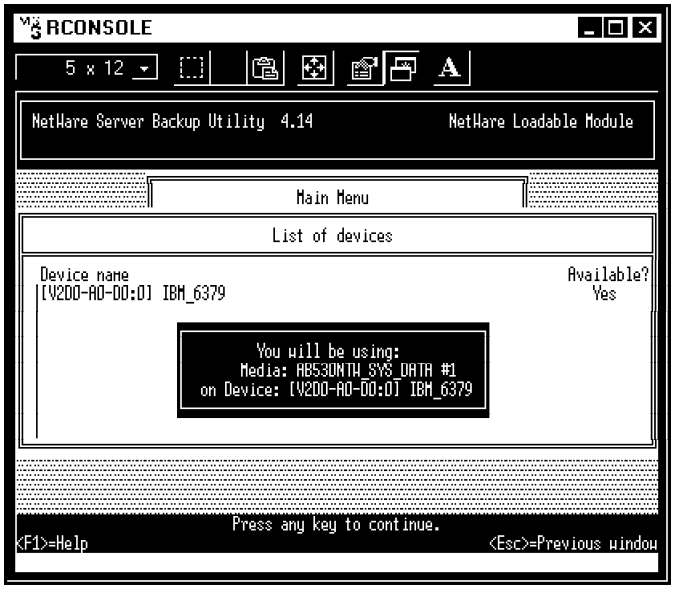


Figure 96. SBACKUP Storage Device Administration

If the device allocation with the AS400TP ALC x statement did not work or you forgot the LIST DEVICES statement, you get the following error message when doing the storage device allocation.

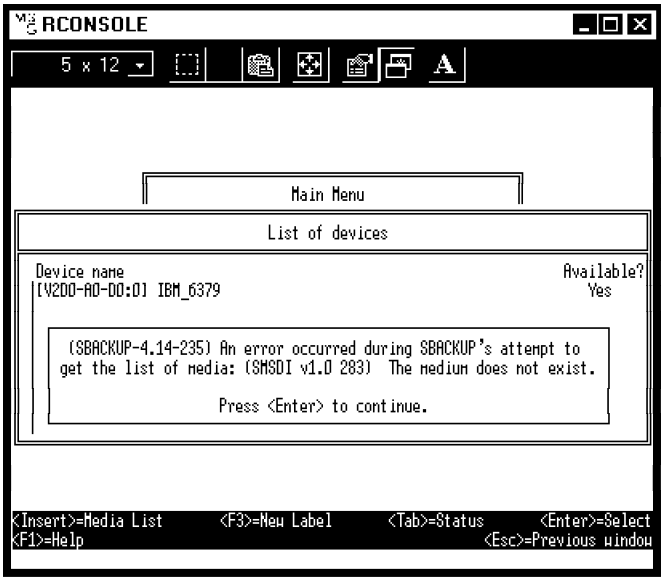


Figure 97. SBACKUP Error Message When AS/400 Tape Not Allocated

If everything went right, you get the following message at the SBACKUP storage device allocation:

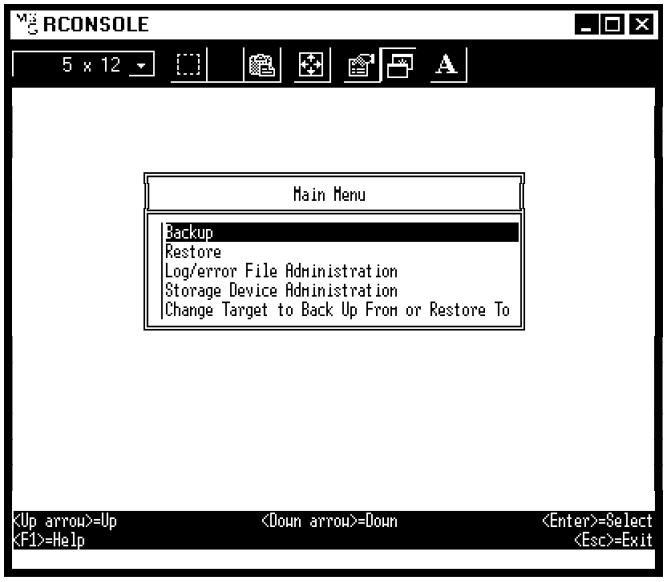


Figure 98. SBACKUP OK Message When AS/400 Tape is Allocated

At this point in time, you are ready to do backup/restore operations to the AS/400 tape drive using the SBACKUP software. When you are done with Novell NetWare backup/restore operations, you can de-allocate the tape drive from Novell NetWare without unloading SBACKUP and use the drive for OS/400 operations. To de-allocate the tape drive from Novell NetWare, you can enter the following command from the RCONSOLE session:

```
AS400TP DLC x
```

where x is the tape drive number assigned at the allocation of the tape drive.

12.3.5 Using Tape Pipe with Cheyenne ARCserve 6 for NetWare

Before using Cheyenne ARCserve 6 for NetWare with the tape pipe support, make sure that you have the latest version of the Cheyenne ARCserve 6 for NetWare fixes installed on the Integrated PC Server. You can download that fix package from the Internet.

You also need a special Cheyenne ARCserve 6 for NetWare update for the AS/400 Integrated PC Server This updated version of the TAPESVR.NLM can also be downloaded from the Internet. Both downloads can be started from the Internet page:

```
http://www.as400.ibm.com/products/software/netware/as4nwtape.htm
```

Once you have made the AS/400 tape drive available to Novell NetWare as previously described, you can start loading the backup/restore software you want to use. The statements you have to enter differ depending on the software product you are using. For Cheyenne ARCserve 6 for NetWare, enter the following commands from the RCONSOLE session:

- LOAD NWASPI
- LOAD ASDB
- LOAD ASPIBD USEABOVE16
- LOAD TAPESVR USEABOVE16
- LOAD ARCSERVE

You can now start backing up/restoring Novell NetWare data to or from the AS/400 tape drive using Cheyenne ARCserve 6 for NetWare. When you finish the Novell NetWare backup/restore operations, you can de-allocate the tape drive from Novell NetWare by using the statement AS400TP DLC x and give the tape drive back to OS/400. Cheyenne ARCserve 6 for NetWare does not have to be unloaded for this operation.

12.3.6 Streamlining Tape Pipe Operation

Operating the tape pipe as described up to now involves a lot of manual input from the console session. The process can and should be automated and performance improved. There are different ways to do that, and the following paragraphs show some of the ways.

12.3.6.1 Statements in AUTOEXEC.NCF and STARTUP.NCF for SBACKUP

Instead of entering the statements through the RCONSOLE session, you can add them to the AUTOEXEC.NCF and STARTUP.NCF files so that the support is automatically loaded every time Novell NetWare is started on the Integrated PC Server.

For SBACKUP, you can add the following statements to the AUTOEXEC.NCF file:

- LOAD AS400TP.HAM
- LOAD TSA410

You might add the following statements:

- AS400TP ALC x
- LIST DEVICES
- LOAD SBACKUP

where x stands for the drive number of the AS/400 tape drive.

This approach, however, only works if at the time the Integrated PC Server is varied on, the AS/400 tape drive you are allocating to Novell NetWare is varied off. Also the tape drive number must be known and is fixed.

A more flexible approach is not to do the last part (the allocation and starting SBACKUP in the AUTOEXEC.NCF file). Instead, this can be done from OS/400 using the OS/400 SBMNWSCMD command. This has several advantages:

- You can switch the allocation of the tape drive back and forth between OS/400 and Novell NetWare.
- You can integrate these commands in existing AS/400 save/restore job streams.

The following CL programs to do a flexible allocation/de-allocation and loading/unloading of SBACKUP are simple examples of how it can be done.

12.3.6.2 CL Program to Start SBACKUP on Integrated PC Server

```
CALL PGM(STRSBKSRV) PARM('ITSCNTWF' 'TAP01')
```

This is the STRSBKSRV program:

```
PGM         PARM(&SERVER &TAPEDRV)
DCL         VAR(&SERVER) TYPE(*CHAR) LEN(50)
DCL         VAR(&TAPEDRV) TYPE(*CHAR) LEN(10)
VRYCFG      CFGOBJ(&TAPEDRV) CFGTYPE(*DEV) STATUS(*OFF) +
              RANGE(*OBJ)
MONMSG      MSGID(CPF0000)
SBMNWSCMD   CMD('as400tp alc 0') SERVER(&SERVER) +
              SVRTYPE(*NETWARE) CMDTYPE(*LCLNTW)
MONMSG      MSGID(CPF0000)
SBMNWSCMD   CMD('SCAN FOR NEW DEVICES') SERVER(&SERVER) +
              SVRTYPE(*NETWARE) CMDTYPE(*LCLNTW)
MONMSG      MSGID(CPF0000)
SBMNWSCMD   CMD('load sbackup') +
              SERVER(&SERVER) SVRTYPE(*NETWARE) +
              CMDTYPE(*LCLNTW)
MONMSG      MSGID(CPF0000)
ENDPGM
```

Figure 99. Starting SBACKUP Support on Integrated PC Server from an AS/400 CL Program

The same way that you start SBACKUP from OS/400, you can also end it. Again, the following program should be taken as just an example.

12.3.6.3 CL Program to End SBACKUP on Integrated PC Server

```
CALL PGM(ENDSBKSRV) PARM('ITSCNTWF' 'TAP01')
```

This is the ENDSBKSRV program:

```
PGM         PARM(&SERVER &TAPDRV)
DCL         VAR(&SERVER) TYPE(*CHAR) LEN(50)
DCL         VAR(&TAPDRV) TYPE(*CHAR) LEN(10)
SBMNWSCMD   CMD('unload sbackup') SERVER(&SERVER) +
              SVRTYPE(*NETWARE) CMDTYPE(*LCLNTW)
MONMSG      MSGID(CPF0000)
SBMNWSCMD   CMD('as400tp dlc 0') SERVER(&SERVER) +
              SVRTYPE(*NETWARE) CMDTYPE(*LCLNTW)
MONMSG      MSGID(CPF0000)
DLYJOB      DLY(10)
VRYCFG      CFGOBJ(&TAPDRV) CFGTYPE(*DEV) STATUS(*ON) +
              RANGE(*OBJ)
MONMSG      MSGID(CPF0000)
ENDPGM
```

Figure 100. Ending SBACKUP Support on Integrated PC Server from an AS/400 CL Program

Another way of handling the switching of the tape drive between OS/400 and Novell NetWare in a flexible manner is to just do the allocating/de-allocating in a OS/400 CL program. As already previously mentioned, SBACKUP does not have to be unloaded before de-allocating the AS/400 tape drive from Novell NetWare. This way, SBACKUP (once it is loaded, either manually by a statement in AUTOEXEC.NCF, or through the CL program shown in Section 12.3.6.2, “CL Program to Start SBACKUP on Integrated PC Server” on page 159) can remain loaded as long as the Integrated PC Server is up. The tape drive can still be switched between OS/400 and Novell NetWare. Figure 101 on page 161 and Figure 102 on page 161 show the CL programs.

12.3.6.4 Allocating AS/400 Tape Drive to Novell NetWare on Integrated PC Server

```
CALL PGM(ALCTAP) PARM('ITSCNTWF' 'TAP01')
```

```
PGM         PARM(&SERVER &TAPEDRV)
DCL         VAR(&SERVER) TYPE(*CHAR) LEN(50)
DCL         VAR(&TAPEDRV) TYPE(*CHAR) LEN(10)
VRYCFG      CFGOBJ(&TAPEDRV) CFGTYPE(*DEV) STATUS(*OFF) +
              RANGE(*OBJ)
MONMSG      MSGID(CPF0000)
SBMNWSCMD   CMD('as400tp alc 0') SERVER(&SERVER) +
              SVRTYPE(*NETWARE) CMDTYPE(*LCLNTW)
MONMSG      MSGID(CPF0000)
SBMNWSCMD   CMD('SCAN FOR NEW DEVICES') SERVER(&SERVER) +
              SVRTYPE(*NETWARE) CMDTYPE(*LCLNTW)
MONMSG      MSGID(CPF0000)
ENDPGM
```

Figure 101. Allocating AS/400 Tape Drive to Novell NetWare on Integrated PC Server

12.3.6.5 De-Allocating AS/400 Tape Drive from Novell NetWare on Integrated PC Server

```
CALL PGM(DLCTAP) PARM('ITSCNTWF' 'TAP01')
```

```
PGM         PARM(&SERVER &TAPDRV)
DCL         VAR(&SERVER) TYPE(*CHAR) LEN(50)
DCL         VAR(&TAPDRV) TYPE(*CHAR) LEN(10)
SBMNWSCMD   CMD('as400tp dlc 0') SERVER(&SERVER) +
              SVRTYPE(*NETWARE) CMDTYPE(*LCLNTW)
MONMSG      MSGID(CPF0000)
DLYJOB      DLY(10)
VRYCFG      CFGOBJ(&TAPDRV) CFGTYPE(*DEV) STATUS(*ON) +
              RANGE(*OBJ)
MONMSG      MSGID(CPF0000)
ENDPGM
```

Figure 102. De-Allocating AS/400 Tape Drive from Novell NetWare on Integrated PC Server

12.3.6.6 Statements in AUTOEXEC.NCF and STARTUP.NCF for Cheyenne ARCserve 6 for NetWare

As for SBACKUP, you can add the statements to the AUTOEXEC.NCF and STARTUP.NCF files so that the support is automatically loaded every time Novell NetWare is started on the Integrated PC Server.

For Cheyenne ARCserve 6 for NetWare, add the following statement to the **STARTUP.NCF** file:

- SET RESERVED BUFFERS BELOW 16 MEG=200

Add this statement to improve the performance.

Add the following statements to the AUTOEXEC.NCF file:

- Search add sys:\arcserve.6\nlm:

 This statement allows you to specify the following load statements without the complete directory path.

- Set minimum directory cache buffers=500:

 This statement improves the performance.

- LOAD AS400TP.HAM
- LOAD NWASPI
- LOAD ASDB
- LOAD ASPIBD USEABOVE16
- LOAD TAPESVR USEABOVE16

The ″useabove16″ parameter in the preceding LOAD statements improves the performance of the tape operations.

You might add the following statements:

- AS400TP ALC x
- LIST DEVICES
- LOAD ARCSERVE

where x stands for the drive number of the AS/400 tape drive.

Again, this approach is rather inflexible and requires the AS/400 tape drive to be varied off at the time the Integrated PC Server is varied on. To improve the flexibility, you can again do some of the operating from an OS/400 CL program as the following paragraphs show.

12.3.6.7 CL Program to Start Cheyenne ARCserve 6 for NetWare on Integrated PC Server

```
CALL PGM(STRARCSRV) PARM('ITSCNTWF' 'TAP01')
```

```
PGM         PARM(&SERVER &TAPEDRV)
DCL         VAR(&SERVER) TYPE(*CHAR) LEN(50)
DCL         VAR(&TAPEDRV) TYPE(*CHAR) LEN(10)
VRYCFG      CFGOBJ(&TAPEDRV) CFGTYPE(*DEV) STATUS(*OFF) +
              RANGE(*OBJ)
MONMSG      MSGID(CPF0000)
SBMNWSCMD   CMD('as400tp alc 0') SERVER(&SERVER) +
              SVRTYPE(*NETWARE) CMDTYPE(*LCLNTW)
MONMSG      MSGID(CPF0000)
SBMNWSCMD   CMD('SCAN FOR NEW DEVICES') SERVER(&SERVER) +
              SVRTYPE(*NETWARE) CMDTYPE(*LCLNTW)
MONMSG      MSGID(CPF0000)
SBMNWSCMD   CMD('load tapesvr useabove16') +
              SERVER(&SERVER) SVRTYPE(*NETWARE) +
              CMDTYPE(*LCLNTW)
MONMSG      MSGID(CPF0000)
SBMNWSCMD   CMD('load arcserve') SERVER(&SERVER) +
              SVRTYPE(*NETWARE) CMDTYPE(*LCLNTW)
MONMSG      MSGID(CPF0000) /* EXEC(GOTO CMDLBL(END)) */
ENDPGM
```

Figure 103. Starting Cheyenne ARCserve 6 for NetWare Support on Integrated PC Server from an AS/400 CL Program

Needless to say, the statements submitted using the SBMNWSCMD command should not be in the AUTOEXEC.NCF file if this approach is used.

The corresponding program to end Cheyenne ARCserve 6 for NetWare on the Integrated PC Server follows.

12.3.6.8 CL Program to End Cheyenne ARCserve 6 for NetWare on Integrated PC Server

```
CALL PGM(ENDARCSRV) PARM('ITSCNTWF' 'TAP01')
```

```
PGM         PARM(&SERVER &TAPDRV)
DCL         VAR(&SERVER) TYPE(*CHAR) LEN(50)
DCL         VAR(&TAPDRV) TYPE(*CHAR) LEN(10)
SBMNWSCMD   CMD('unload arcserve') SERVER(&SERVER) +
              SVRTYPE(*NETWARE) CMDTYPE(*LCLNTW)
MONMSG      MSGID(CPF0000)
SBMNWSCMD   CMD('unload standard') SERVER(&SERVER) +
              SVRTYPE(*NETWARE) CMDTYPE(*LCLNTW)
MONMSG      MSGID(CPF0000)
SBMNWSCMD   CMD('unload tapesvr') SERVER(&SERVER) +
              SVRTYPE(*NETWARE) CMDTYPE(*LCLNTW)
MONMSG      MSGID(CPF0000)
SBMNWSCMD   CMD('as400tp dlc 0') SERVER(&SERVER) +
              SVRTYPE(*NETWARE) CMDTYPE(*LCLNTW)
MONMSG      MSGID(CPF0000)
DLYJOB      DLY(10)
VRYCFG      CFGOBJ(&TAPDRV) CFGTYPE(*DEV) STATUS(*ON) +
              RANGE(*OBJ)
MONMSG      MSGID(CPF0000)
ENDPGM
```

Figure 104. Ending Cheyenne ARCserve 6 for NetWare Support on Integrated PC Server from an AS/400 CL Program

You can implement an even more flexible approach if you load the Cheyenne ARCserve 6 for NetWare support through AUTOEXEC.NCF, but do the allocating/de-allocating of the AS/400 tape drive through CL programs. This way the Cheyenne ARCserve 6 for NetWare support is loaded only once and stays resident all the time. The AS/400 tape drive is switched back and forth between OS/400 and Novell NetWare by allocating/de-allocating it.

12.3.6.9 Allocating/De-Allocating AS/400 Tape Drive from Novell NetWare

To allocate or de-allocate an AS/400 tape drive from Cheyenne ARCserve 6 for NetWare, you can use the same CL programs as shown in Figure 101 on page 161 and in Figure 102 on page 161.

12.4 Save/Restore Data Using Network Tape Drive

This backup method does not use any AS/400 resources. It uses Novell NetWare software such as SBACKUP or Cheyenne ARCserve 6 for NetWare to back up or restore data to a tape drive on the LAN. The AS/400 system is involved only insofar as the data to be backed up or restored might be on the server storage space of an Integrated PC Server.

All the handling is done from the Novell NetWare console or from a Novell NetWare client; no AS/400 operation is necessary. If data is saved from an

Integrated PC Server, the network server description must be varied on and the Novell NetWare server must be active on the Integrated PC Server. Other than that, the AS/400 system is not involved in the backup/restore process.

What are the characteristics of this solution?

Characteristics are:

- No additional software is needed on the AS/400 system; OS/400 (57xx-SS1) and 57xx-SA2 are sufficient.
- In a Novell NetWare multi-server environment where the AS/400 Integrated PC Server is only one of the network servers, data from all servers in the network (including the Integrated PC Server) can be saved/restored the same way.
- If the Novell NetWare network existed before the AS/400 system with its Integrated PC Server was integrated into it, no new skills for backup/restoring data are necessary since the backup software was used previously.
- The method is fast and only depends on the speed of the drive.
- In addition to the tape drive (or drives) of the AS/400 system, network tape drives attached to other server (or servers) are necessary. When the AS/400 system has fast tape drives (possibly with magazines), it is convenient to use the tape drive (or drives) that the AS/400 system provides.
- Two completely separate backup strategies exist, one for AS/400 data and the other one for Novell NetWare data. No integration between the two backup procedures exists. This might mean additional operator work.

Looking at the advantages and disadvantages of this approach, it looks as if this approach is only viable in an environment where the Novell NetWare network already exists and the AS/400 system is only loosely integrated into the network. Existing backup procedures remain unchanged. The approach can also be used in a transition phase towards the method explained in Section 12.3, “Save/Restore Data to AS/400 Tape Using ″Tape Pipe″” on page 151.

12.5 Save/Restore Data Using ADSM

12.6 Save/Restore Data Using AS/400 IFS

This backup method is available with the OS/400 Enhanced Integration for Novell NetWare feature of OS/400 V3R7, option 25. This feature enables the AS/400 system to ″see″ the file system and NDS objects on servers in a Novell NetWare network. Under the IFS directory, **QNetWare**, the data structure of all the servers and NDS trees in the network (not just the Integrated PC Server server) can be seen. In V3R7 with a production date of 02/28/97 or later or Cumulative PTF Package C7029370 applied, the SAV and RST commands of OS/400 can be used to process the corresponding IFS directory entries. This is practically the opposite of the method described in Section 12.4, “Save/Restore Data Using Network Tape Drive” on page 164; while that method did not involve any AS/400 actions, this method does not involve any Novell NetWare actions.

What are the advantages/disadvantages of this solution?

Advantages are:

- Any data from any physical server running the Enhanced Integration NLM in the network can be backed up.
- Save/restore of single objects is possible. The save/restore entity can be a complete Novell NetWare volume but it can also be a single file (remember, independent of the physical server the object is stored on, whether it is an Integrated PC Server or a PC based Novell NetWare server).
- A subset of the data that is saved can be restored from the backup tape.
- The Integrated PC Server can remain active; the network server description does not have to be placed offline.
- This method takes advantage of AS/400 saving mechanisms such as high speed tape drives, magazine drives, or save files.
- The method can be completely integrated into existing AS/400 save/restore procedures. AS/400 customers usually save data in a nightly, unattended job. Saving the Novell NetWare data with this method can be integrated into the nightly, unattended AS/400 job.

Disadvantages are:

- The speed of the save operation. Saving IFS data usually takes more time than saving Novell NetWare data with SBACKUP or ARCserve. It is

up to the user to evaluate if the reduced saving speed is made up for by the integration of the save job into the AS/400 save procedure.

At the time this redbook was printed, some tests suggested that the performance was approximately within 10% of the performance of Cheyenne ARCserve 6 for NetWare (this is by no means a representative figure).

12.6.1 How Is It Done?

A prerequisite is that the Enhanced Integration NLM needs to be loaded on the server.

You need to have sufficient authorization to perform save/restore in QNetWare. You can use the ADDNTWAUTE command to the NDS or 3.12 server you are saving from or restoring to. You can also use the STRNTWCNN command and specify CNNTYPE(*YES). As already mentioned, the OS/400 commands used to save/restore data in the IFS are **SAV** and **RST**. Remember that the names in the IFS referring to Novell NetWare objects such as a server use a specific syntax with a name extension. To address a server with the name of ITSCNTWF in the IFS, you have to specify the name of the server together with an extension of **.SVR**.

In an OS/400 command, therefore, refer to a server with the name:

```
ITSCNTWF.SVR
```

Figure 105 on page 168 shows how the **SYS** volume of the server ITSCNTWF is saved to the save file **ITSCF** in library **QGPL** on the AS/400 system. Keep in mind that the server whose system volume is saved might be an Integrated PC Server on the AS/400 system where the command is entered, or might be a server on the Integrated PC Server of another AS/400 system in the network, or might be a PC based server in the network.

Note

If you save data from a PC Server in the network, make sure you specify *RMT or *ALL for the SYSTEM parameter in the SAV command.

```
                              Save Object (SAV)

Type choices, press Enter.

Device . . . . . . . . . . . . . DEV          > '/qsys.lib/qgpl.lib/itscf.file'

                           + for more values

Objects:                          OBJ
  Name . . . . . . . . . . . . .               > '/qnetware/itscntwf.svr/sys'

  Include or omit  . . . . . . .                 *INCLUDE
                           + for more values
Directory subtree  . . . . . . . SUBTREE        *ALL
Save active  . . . . . . . . . . SAVACT         *NO
Output . . . . . . . . . . . . . OUTPUT         *NONE

                            Additional Parameters

System . . . . . . . . . . . . . SYSTEM         *LCL
Time period for last change:     CHGPERIOD
  Start date . . . . . . . . . .                *ALL
  Start time . . . . . . . . . .                *ALL
  End date . . . . . . . . . . .                *ALL
  End time . . . . . . . . . . .                *ALL
Object pre-check . . . . . . . . PRECHK         *NO
Target release . . . . . . . . . TGTRLS         *CURRENT
Update history . . . . . . . . . UPDHST         *NO

Clear  . . . . . . . . . . . . . CLEAR        > *ALL
Data compression . . . . . . . . DTACPR       > *YES
Data compaction  . . . . . . . . COMPACT        *DEV
```

Figure 105. SAV Command to Save Novell NetWare Server System Volume

The following name refers to directory **ARCSERVE.6** on the system volume of the Novell NetWare server ITSCNTWF.

```
/QNetWare/ITSCNTWF.SVR/SYS/ARCSERVE.6
```

One of the advantages of this approach is that single objects can be restored from a backup of a larger entity such as a volume or a complete server.

Figure 106 on page 169 shows how data within a specific directory can be restored from the backup produced with the command in Figure 105.

```
                          Restore Object (RST)

Type choices, press Enter.

Device . . . . . . . . . . . . . DEV          > '/qsys.lib/qgpl.lib/itscf.file'

                         + for more values

Objects:                          OBJ
  Name . . . . . . . . . . . . .              > '/qnetware/itscntwf.svr/sys/as4nw'

  Include or omit  . . . . . . .                *INCLUDE
  New object name  . . . . . . .                *SAME

                         + for more values
```

Figure 106. RST Command to Restore Directory AS4NW to Novell NetWare Server SYS Volume

To perform the same operations as shown in Figure 105 on page 168 and Figure 106 to a tape drive instead of a save file, the command looks similar to this:

```
                            Save Object (SAV)

Type choices, press Enter.

Device . . . . . . . . . . . . . > '/qsys.lib/tap01.devd'

              + for more values

Objects:
  Name . . . . . . . . . . . . . > '/qnetware/itscntwf.svr/sys'

  Include or omit  . . . . . . .   *INCLUDE      *INCLUDE, *OMIT
             + for more values
Directory subtree  . . . . . . .   *ALL          *ALL, *DIR, *NONE, *OBJ
Save active  . . . . . . . . . .   *NO           *NO, *YES, *SYNC
Output . . . . . . . . . . . . .   *NONE
```

Figure 107. SAV Command to Save SYS Volume of Server ITSCNTWF to Tape

As you can see, the parameters to specify are the same, except that the device name differs. Again, be aware of the name extension used in IFS to refer to devices (such as **DEVD** referring to a physical device).

The following figure shows how data can be restored from the tape created with the previous SAV operation. Again, while the SAV operation saved a complete volume, the RST operation in the following figure only restores one directory with its files.

```
                          Restore Object (RST)

Type choices, press Enter.

Device . . . . . .   'qsys.lib/tap01.devd'

               + for more values

Objects:
  Name . . . . . .   'qnetware/itscntwf.svr/sys/as4nw'

  Include or omit  . . . . . .   *INCLUDE      *INCLUDE, *OMIT
  New object name  . . . . . .   *SAME

               + for more values
Directory subtree  . . . . . .   *ALL          *ALL, *DIR, *NONE, *OBJ
Output . . . . . .   *NONE
```

Figure 108. RST Command to Restore Directory AS4NW from Tape

The SAV/RST operations for the IFS can also be used to save a Novell NetWare volume and restore the data (or a part of it) to a different volume. The following figures show how that can be done.

In Figure 109, the Novell NetWare drive **DATA1** from the server ITSCNTWF is saved to an AS/400 save file.

```
                            Save Object (SAV)

Type choices, press Enter.

Device . . . . . . DEV          > 'qsys.lib/qgpl.lib/itscf

                         + for more values

Objects:                       OBJ
  Name . . . . . .             > 'qnetware/itscntwf.svr/data1

  Include or omit  . . . . . .   *INCLUDE
                         + for more values
Directory subtree  . . . . . . SUBTREE        *ALL
Save active  . . . . . . . . . SAVACT         *NO
Output . . . . . . . . . . . . OUTPUT         *NONE
```

Figure 109. Save Novell NetWare Volume DATA1 to an AS/400 Save File

The following figure shows the job log of the job doing the save operation. Do not be afraid when the messages `Cannot save or restore .......` show up. For the Novell NetWare files, you can see in this figure that the message is normal since these files are Novell NetWare temporary files that

do not have to be saved. Therefore, even with these messages in the job log, the save operation has been successfully performed.

```
3 > SAV DEV('qsys.lib/qgpl.lib/itscf.file') OBJ(('qnetware/itscntwf.svr/d
  ata1')) DTACPR(*YES)
  Started *USER connection 12 to server ITSCNTWF.
  Started *USER connection 9 to server ITSCNTWF.
  Started *SAVRST connection 12 to server ITSCNTWF.
  Cannot save or restore
    /qnetware/itscntwf.svr/DATA1/SYSTEM/TSA/TSA$TEMP.001.
  Cannot save or restore
    /qnetware/itscntwf.svr/DATA1/SYSTEM/TSA/TSA$TEMP.002.
  Cannot save or restore
    /qnetware/itscntwf.svr/DATA1/SYSTEM/TSA/TSA$TEMP.003.
  Cannot save or restore
    /qnetware/itscntwf.svr/DATA1/SYSTEM/TSA/TSA$TEMP.000.
  2178 objects saved.
```

Figure 110. Job Log of SAV Operation for Novell NetWare Volume DATA1

The following figure shows the RST command used to restore the Novell NetWare volume DATA1 that has been saved to an AS/400 save file as shown in Figure 109 on page 170. Keep in mind that the data is restored not to volume DATA1 but to volume DATA2.

```
                            Restore Object (RST)

 Type choices, press Enter.

 Device . . . . . . . . . . . . DEV          > 'qsys.lib/qgpl.lib/itscf
ile'
                          + for more values

 Objects:                           OBJ
   Name . . . . . . . . . . . .               > 'qnetware/itscntwf.svr/data1

   Include or omit  . . . . . .                 *INCLUDE
   New object name  . . . . . .               > 'qnetware/itscntwf.svr/data2

                          + for more values
 Directory subtree  . . . . . . . SUBTREE       *ALL
 Output . . . . . . . . . . . . . OUTPUT        *NONE
```

Figure 111. Restore Content of Volume DATA1 to Novell NetWare Volume DATA2

The following figure shows the job log of the job running the restore operation. Again, as in Figure 110, messages show up that seem to indicate there was a problem. Nevertheless, the restore operation was successful.

```
3 > RST DEV('qsys.lib/qgpl.lib/itscf.file') OBJ(('qnetware/itscntwf.svr/d
   ata1' *INCLUDE 'qnetware/itscntwf.svr/data2'))
   Started *USER connection 18 to server ITSCNTWF.
   Started *USER connection 20 to server ITSCNTWF.
   Started *SAVRST connection 18 to server ITSCNTWF.
   New object name not valid.                                    1
   Not able to restore object /qnetware/itscntwf.svr/data2.      1
   2177 objects restored. 1 objects not restored.
```

Figure 112. Job Log of RST Operation of Saved Novell NetWare Volume DATA1 to DATA2

1 These two messages are normal when you restore to a different volume than you originally saved from. Since you are restoring to the DATA2 volume, the system is trying to restore the object **Qnetware/itscntwf.svr/data2**; this "object", however, has never been saved because you saved from the volume DATA1. As the Novell NetWare NDS structure shows, the restore operation has been successful.

The NDS tree of the Novell NetWare volume DATA2 shows that the directory structure and the files in the directory are complete. The DATA2 volume now contains the same directory structure and the same files volume DATA1 contains.

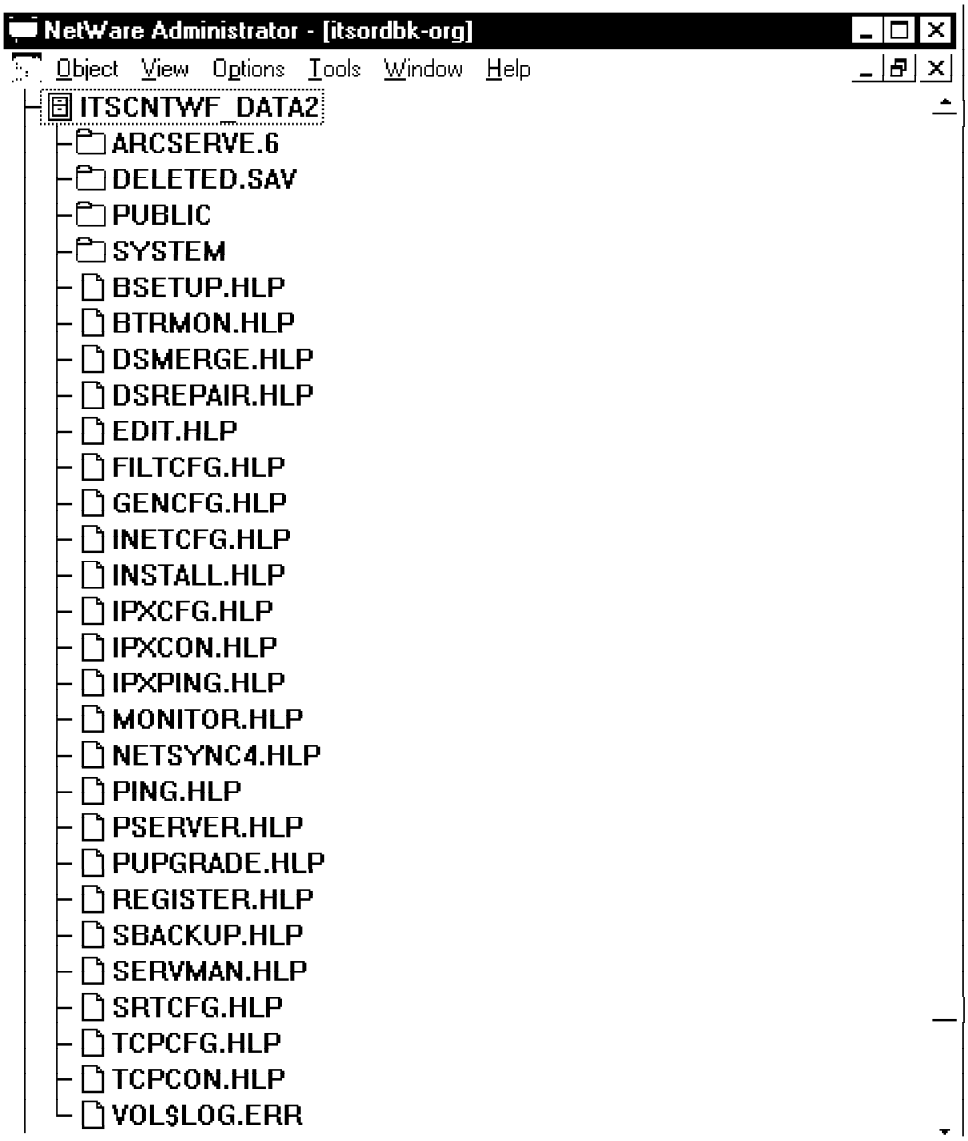


Figure 113. NDS Tree of Volume DATA2 after Restoring DATA1 Backup

12.7 Save/Restore Considerations

With so many different options available, the question comes up: what is the best save/restore strategy? The answer is obvious: there is no ″best″ strategy. The save/restore strategy you choose depends on your

environment and on the hardware and software involved. Factors you must look at are:

- The version and release of OS/400
- The AS/400 hardware (CISC or RISC)
- The tape drives attached to the AS/400 system
- The structure of your existing AS/400 backup operation, mainly if backup is done unattended (night job)

The basic question you have to answer is: should the backup of the Novell NetWare server data be integrated into an existing AS/400 backup procedure, or should the backup of Integrated PC Server data be integrated into the existing Novell NetWare backup strategy, possibly taking advantage of AS/400 tape drives. If you have made that ″strategic″ decision, you can implement the backup procedures you want to use, depending on the hardware and software available to you. The following rules may help you in implementing the backup procedures.

- If you have a Novell NetWare oriented environment where Novell NetWare backup procedures are established and you just want to add an AS/400 Integrated PC Server to the backup procedures, you are probably better off to just save the Integrated PC Server data with Novell NetWare backup software to either the existing network tape drive (or drives) or to an AS/400 tape drive. If the AS/400 tape drive is as fast as the IBM 3590, this might be the best way to go. Keep in mind, however, that the tape pipe support is only available in OS/400 V3R7.
- If you have a more AS/400 oriented environment and want to integrate the backup procedures for the Novell NetWare data into your AS/400 backup procedures, you might be better off using the new IFS support to save/restore the Novell NetWare data. The advantages of this approach are:
 - Complete integration into OS/400 job stream possible
 - Unattended operation possible
 - Same backup media can be used (″OS/400-data″ and ″Novell NetWare-data″ can be intermixed on the same cartridge).

 If you want to take this approach, you need OS/400 V3R7 on the AS/400 system. Previous releases of OS/400 do not support save/restore through IFS. In addition, you need the OS/400 Enhanced Integration for Novell NetWare feature of OS/400, 5716-SS1, option 25.
- What if you have a CICS AS/400 system with OS/400 V3R1 or V3R2? If you have a Novell NetWare network with a tape unit attached to a PC based server, it is best to save the data from the Integrated PC Server

on that tape drive. For a complete backup of all the data on the Integrated PC Server in regular intervals (once a month, or once a week), you might consider saving the network server storage spaces linked to that server. That allows you to do only the incremental backups to the tape drive of the PC based server. Keep in mind that the network server storage space backups allow a full restore only, not a restore on a file level.

If you do not have a tape drive attached to a PC based server, you do not have a choice. Backing up the network server storage spaces is the only way to go. You probably have to do that every day and, again, if you need to restore data, you can do that only by restoring the full storage space, not on a file basis.

Be Aware!

Whenever saving complete network server storage spaces is part of your backup strategy, make sure that a Novell NetWare volume does **not** span multiple storage spaces.

A network server storage space is analog to the Novell NetWare term partition; therefore, a Novell NetWare volume can span multiple network server storage spaces. If you now restore a network server storage space (remember, in this environment, you can only restore complete storage spaces), you restore a fraction of a Novell NetWare volume, which corrupts your database. To avoid that, you have to restore another storage space, the one containing the rest of the Novell NetWare volume (which again might contain a fraction of yet another Novell NetWare volume and so on); that takes time and administrative efforts because you must keep track manually which Novell NetWare volumes are on what network server storage spaces.

Therefore, if your backup concept involves saving full network server storage spaces, never let the Novell NetWare volumes span multiple network server storage spaces.

12.7.1 Performance Considerations

At the time of printing this redbook, no representative performance benchmark was available. On the other hand, performance is important when making your choice between the different backup/restore options.

Just to get a rough idea about the performance of the different options, we did a performance comparison between tape pipe and IFS save restore (probably not representative and not in a controlled environment).

The test saved a Novell NetWare volume with approximately 65MB of data with approximately 2000 files. The saves were done with:

1. SBACKUP using tape pipe to IBM 6379 tape (1/4″ cartridge)
2. Cheyenne ARCserve 6 for NetWare using tape pipe to IBM 6379 tape (1/4″ cartridge)
3. IFS SAV of the volume to IBM 6379 tape (1/4″ cartridge)
4. IFS SAV to an AS/400 save file

The save times of Case 1, Case 2, and Case 3 did not differ much; Case 1 took approximately 7.5 minutes, Case 2 took approximately 8.5 minutes, and Case 3 took approximately 9 minutes. With these time differences, the performance difference between the three methods is not really a deciding factor for the choice of backup options, so you can make your decision based on the functions you want. Naturally, the speed of the tape drive was an influencing factor so we did Case 4 to eliminate the tape speed for the IFS SAV method. The saving time went down to approximately 5 minutes.

Chapter 13. Installing Applications on Integrated PC Server

There are many different ways to install applications on a NetWare server. This chapter shows examples for installing some often used applications on the Integrated PC Server. Some of the often used applications are:

- NetWare 4.1 Online Documentation
- Cheyenne ARCserve
- NetWare for SAA

The installation of NetWare for SAA on the Integrated PC Server is documented in the manual *Integrating AS/400 with Novell NetWare*, SC41-4124, so it is not documented here.

13.1 Installing the Novell NetWare Online Documentation

The same as the OS/400 Enhanced Integration for Novell NetWare, the installation of the Novell NetWare online documentation is done from a console. To install it on the Integrated PC Server, you need a remote console session. While installing the OS/400 Enhanced Integration for Novell NetWare was fairly easy, installing the Novell NetWare online documentation is a bit more complex.

After establishing the console session, the following steps are necessary:

1. Insert the CD-ROM with the Novell NetWare Online Documentation in the CD-ROM drive.
2. Type LOAD INSTALL and press Enter.
3. Select the Product Options line of the Installation Menu and press Enter.
4. Select the ″Choose an item or product listed above″ line of the Other Installation Actions menu.
5. Select the ″Install Online Documentation and Viewers″ line from the ″Other Installation Items/Products″ menu.
6. Press F4 at the following prompt:

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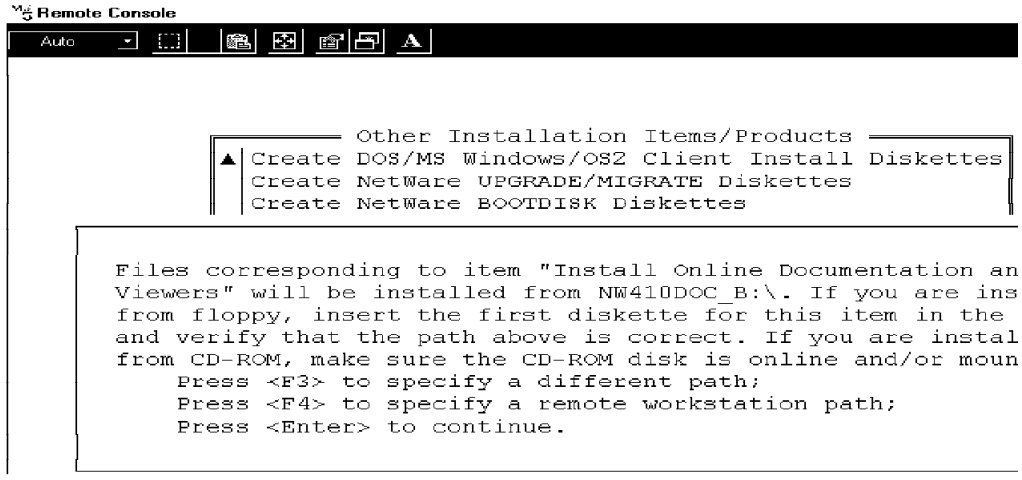


Figure 114. Selecting a Remote Workstation Path

7. Change the following prompt by entering the drive number of your CD-ROM drive. In our example, we use the d: drive.

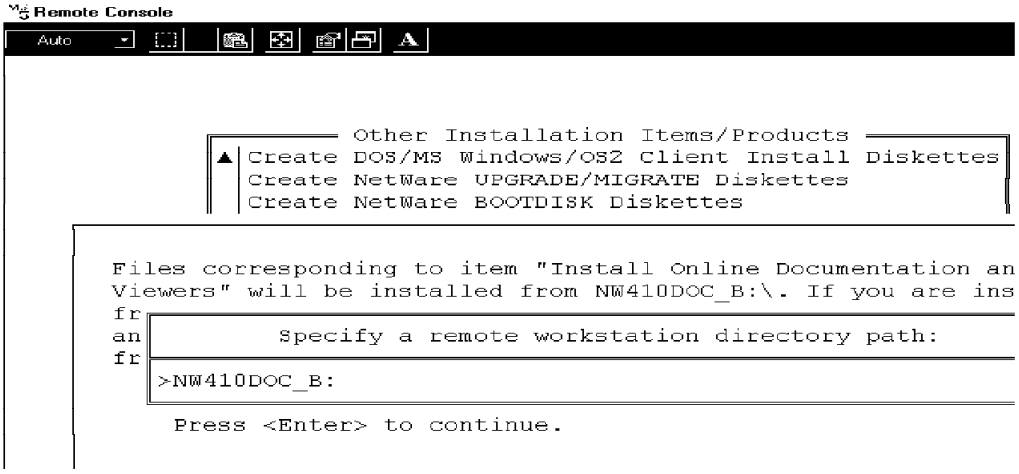


Figure 115. Default Remote Workstation Path

Your console window should now look similar to this:

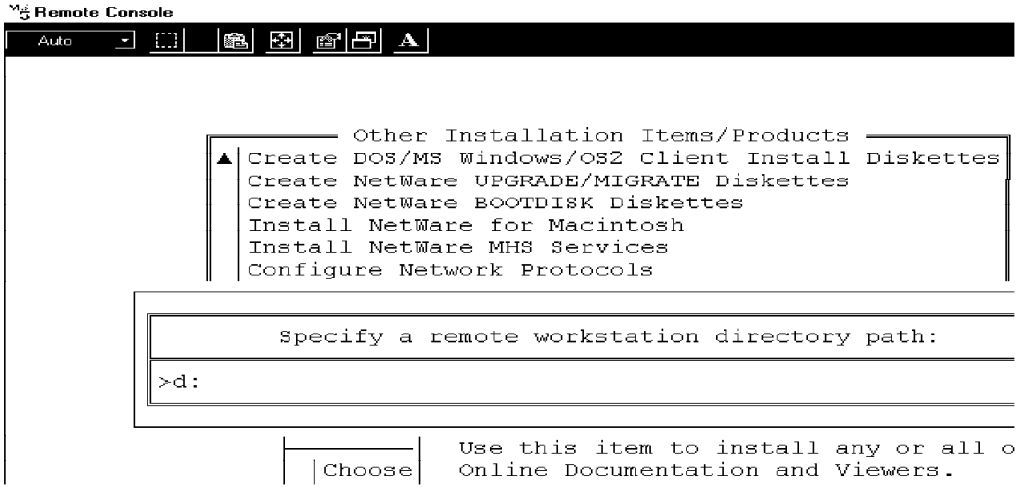


Figure 116. Specifying Remote Workstation Path

8. At the following prompt, do not change the default destination path so that the online documentation is installed on the SYS: volume.

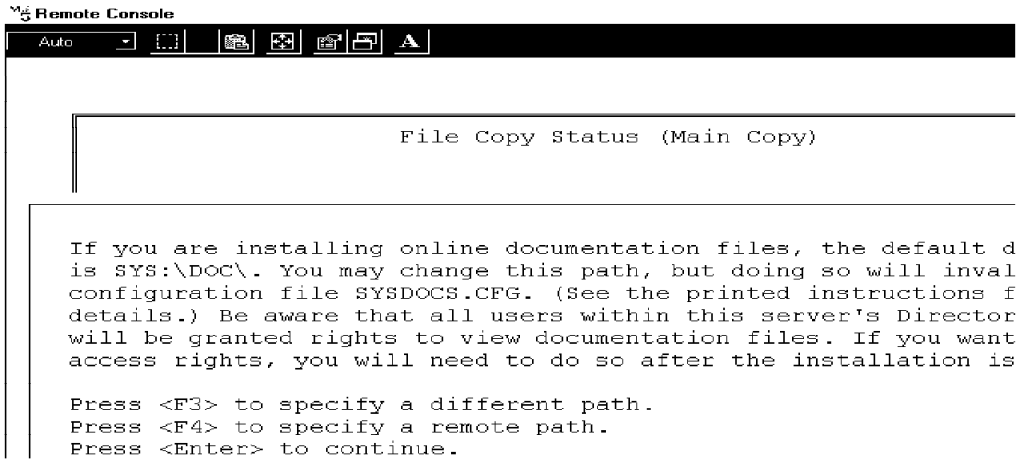


Figure 117. Selecting a Destination Path

9. The NetWare administrator user profile is used for the installation of the online documentation. You are, therefore, prompted to enter the administrator password (the prompt comes up twice). You need to know the administrator password at this point, or you can use a different user in the ″Administrator Name″ box, but need to have enough authority.

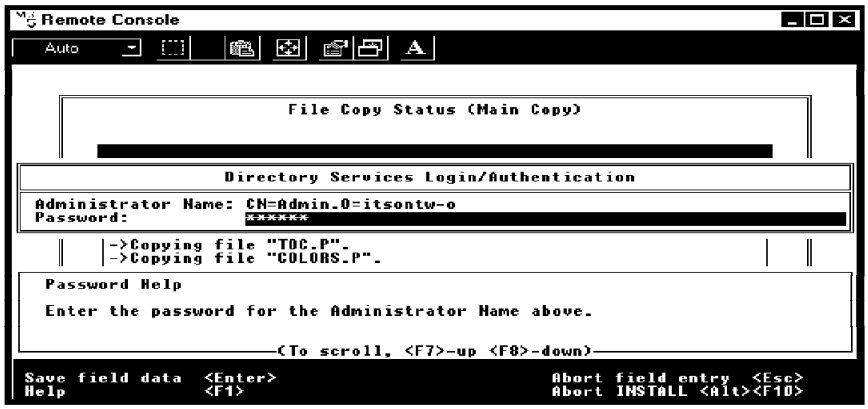


Figure 118. Login as Administrator

The online documentation is now copied onto the Sys: volume associated with the Integrated PC Server.

13.2 Installing Cheyenne ARCserve 6 for NetWare

With the implementation of the AS/400 tape support for the backup of NetWare data, the installation of the Cheyenne ARCserve 6 for NetWare product on the Integrated PC Server is becoming more popular. Cheyenne ARCserve 6 for NetWare is probably the most used product to save and restore the NetWare server and network data. Cheyenne ARCserve 6 for NetWare is installed from a NetWare client workstation, not (as the products mentioned before) from a NetWare console. Therefore, the installation process is different from the ones documented previously.

Also be aware that after the installation of the Cheyenne ARCserve 6 for NetWare product, you probably have to install a Service Pack to the product. You can download it from the Internet. You also need an updated NLM from IBM that you can also download from the Internet.

To download the software from the Internet, which at the time this redbook was printed was needed, proceed with the following steps:

- Request IBM′s AS/400 NetWare support Internet page. The URL is:

 `http://www.as400.ibm.com/products/software/netware/as4nwtape.htm`

- From that page, you have a hyperlink to get to the Cheyenne page for downloading the latest **Service Pack for ARCserve 6**.

- From the same page, you have a hyperlink to download the new **TAPESVR.NLM** needed to run Cheyenne ARCserve 6 for NetWare on the Integrated PC Server. This step is not necessary when a new Service Pack for ARCserve 6 becomes available. The Internet page previously mentioned is updated.

The fix packages downloaded from the Internet contain README files with the necessary instructions to extract the files and install the fixes.

Download the fixes **before** you start installing the Cheyenne ARCserve 6 for NetWare product on the Integrated PC Server.

If you do not use the Enterprise edition of ARCserve, make sure that before starting the installation of Cheyenne ARCserve 6 for NetWare, you also check the licenses for Cheyenne ARCserve 6 for NetWare and for Novell NetWare. Cheyenne ARCserve 6 for NetWare only works on that server if the number of users of the Cheyenne ARCserve 6 for NetWare license is equal to or larger than the number of users of the Novell NetWare license. If the number of licensed Cheyenne ARCserve 6 for NetWare users is smaller than the number of Novell NetWare users, the LOAD ARCSERVE command will fail.

The installation is done the following way:

1. From a client workstation, log in to the NetWare tree in which the Integrated PC Server is located.
2. Insert the CD-ROM with the Cheyenne ARCserve 6 for NetWare product into the CD-ROM drive of the NetWare client workstation. The installation program is automatically started.
3. Click on the ″NEXT″ button on the following window:

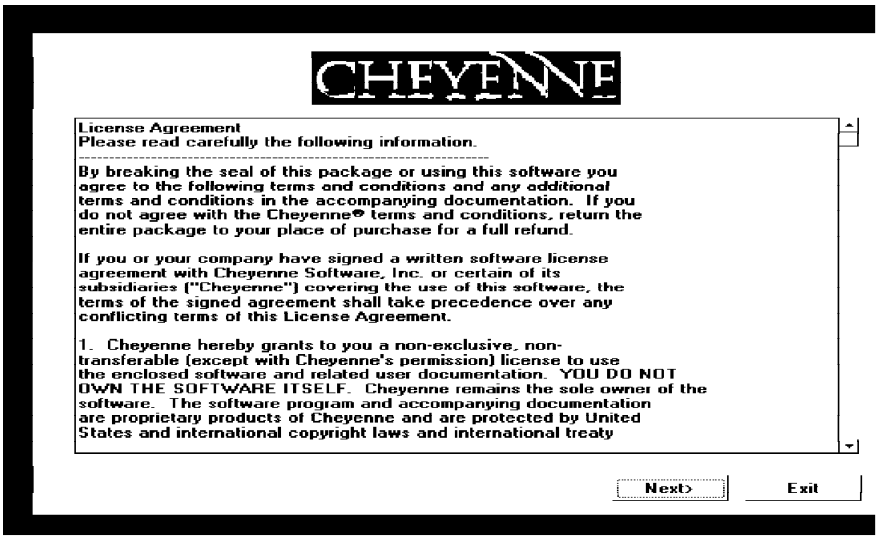


Figure 119. Starting Cheyenne Installation Process

4. Click on the ″NEXT″ button on the following window as well.
5. Select the **Cheyenne ARCserve 6 for NetWare** from the pull-down menu of the following window and press the ″NEXT″ button.

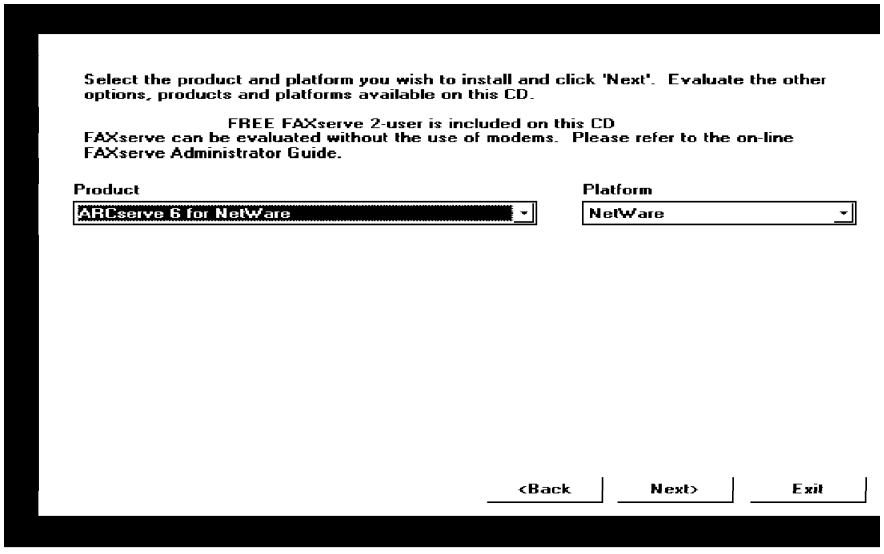


Figure 120. Selecting Cheyenne ARCserve 6 for NetWare Installation

6. On the following window, click on the ″INSTALL″ button.

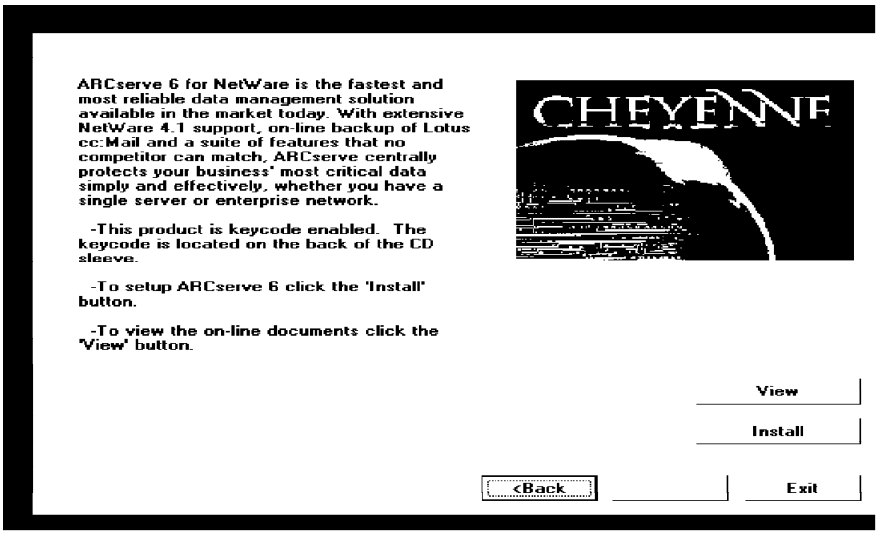


Figure 121. Starting Cheyenne ARCserve 6 for NetWare Installation

7. Click on the ″NEXT″ buttons on the next two windows.
8. On the following window, change the selection to ″Custom″ by clicking on the corresponding button. Click on the ″NEXT″ button to continue.

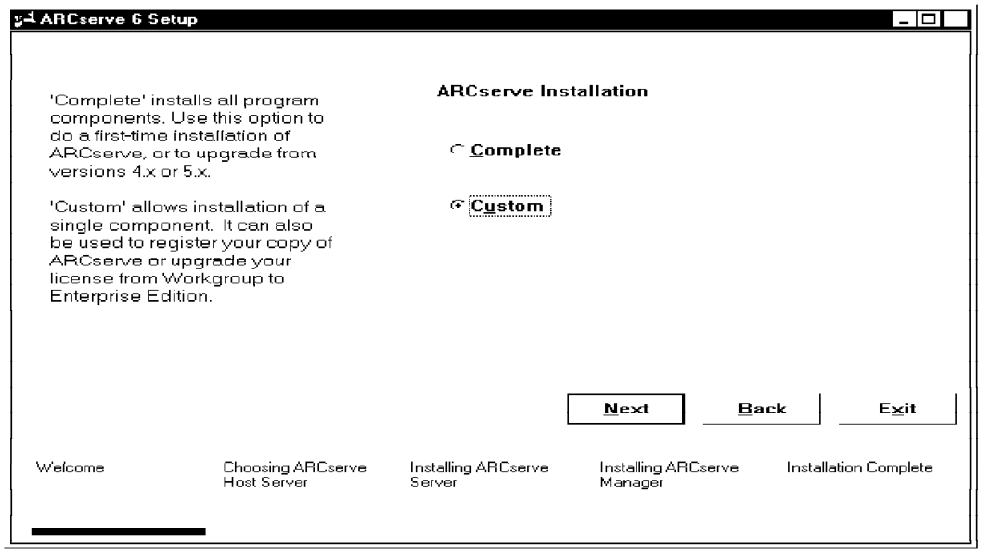


Figure 122. Select Customized Installation

9. For the Cheyenne ARCserve 6 for NetWare server installation, just click on the ″NEXT″ button again on the following window.

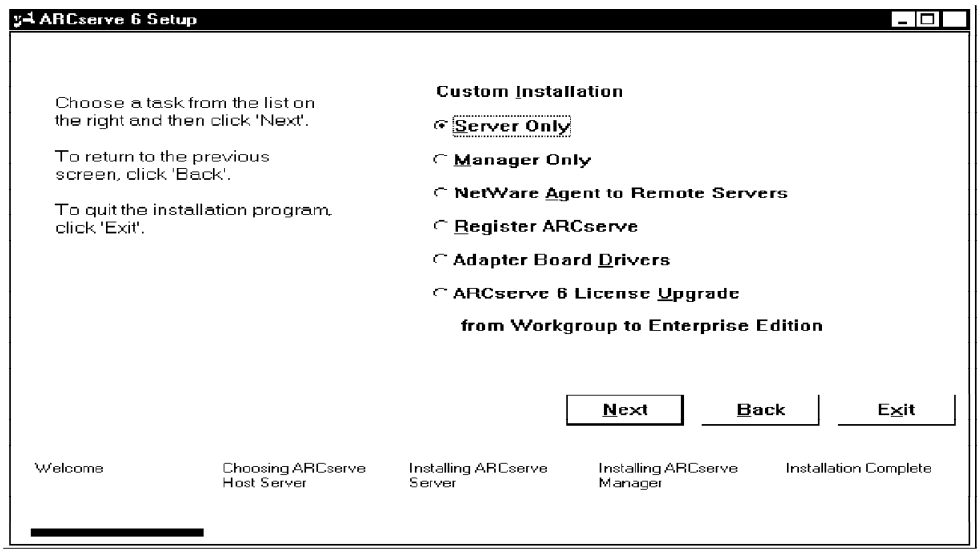


Figure 123. Select ″Server Only″ Installation

10. From the list of servers shown on the next window, select the server where you want to install Cheyenne ARCserve 6 for NetWare. In our case, this should be an Integrated PC Server.

 After selecting the correct server, click on the ″NEXT″ button to continue the installation process.

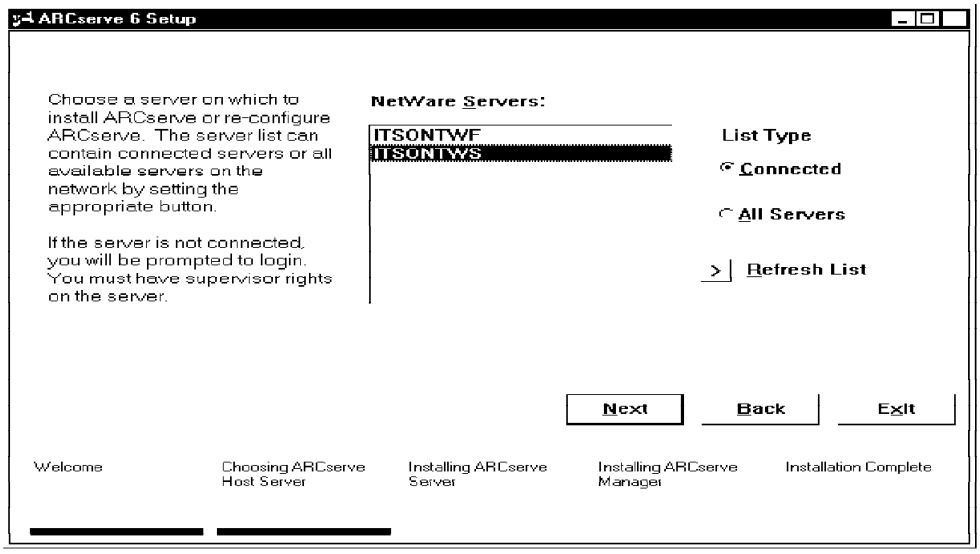


Figure 124. Server Selection

11. Accept the values shown on the next window and continue by clicking on the ″NEXT″ button.
12. Click on the ″NEXT″ button on the next window again.
13. Continue with the ″NEXT″ button until the following window is displayed. On this window, select the ″Key″ license type and enter the license number in the input field. You can usually find the license number on the back of the CD-ROM envelope of the Cheyenne ARCserve 6 for NetWare product.

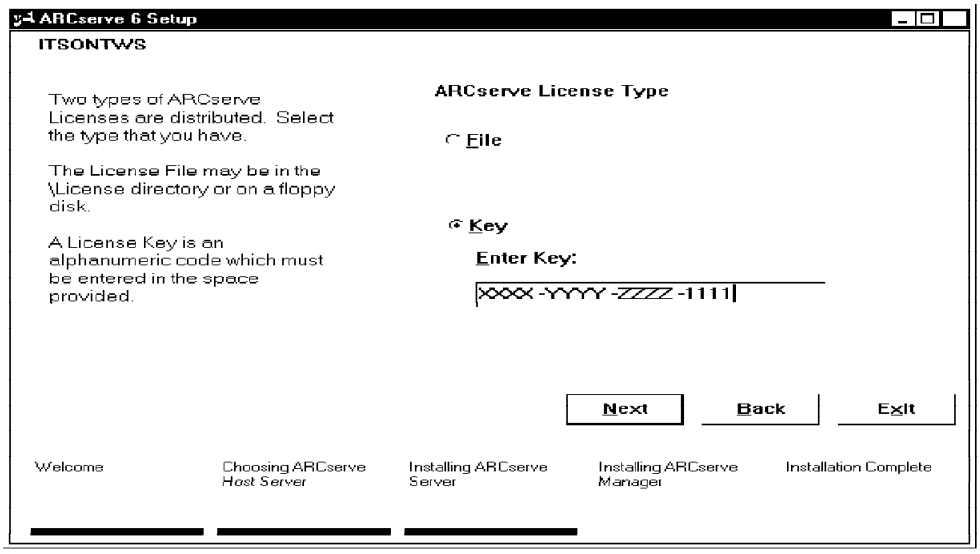


Figure 125. Entering the License Key

14. Click on the ″Yes″ button on the following window. Cheyenne ARCserve 6 for NetWare is now being installed on the Integrated PC Server.

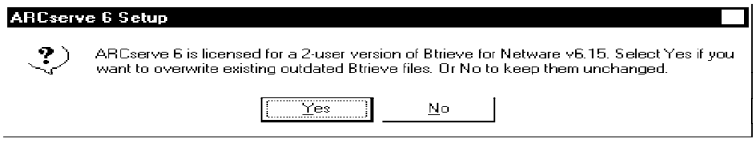


Figure 126. Confirm Overwrite for Btrieve

15. Click on the ″NEXT″ button on the following window.

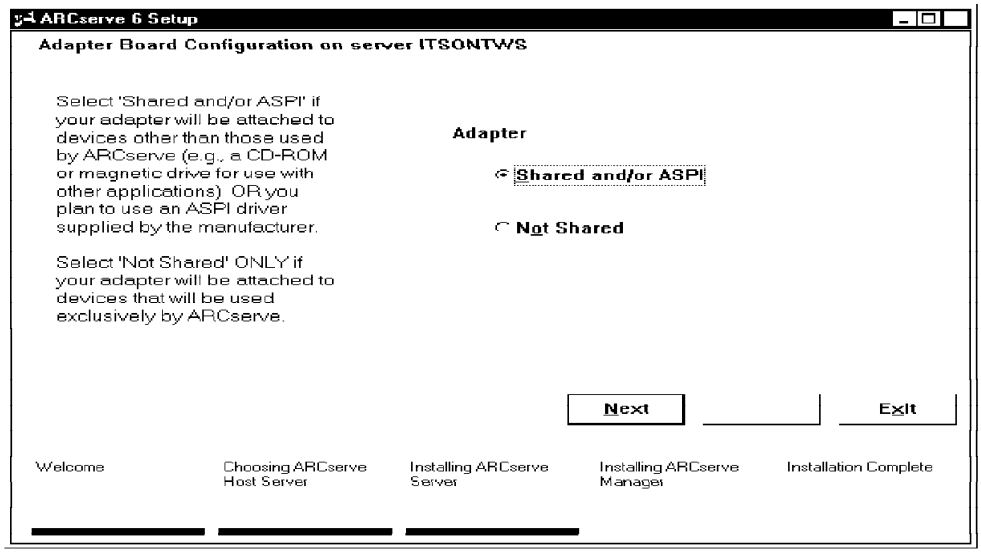


Figure 127. Specify Adapter Sharing

16. On the next window shown here, you have to select a supported adapter. You can select any adapter; it is actually not used when Cheyenne ARCserve 6 for NetWare runs on the Integrated PC Server. However, the installation process requires that you select one. Click on the ″NEXT″ button.

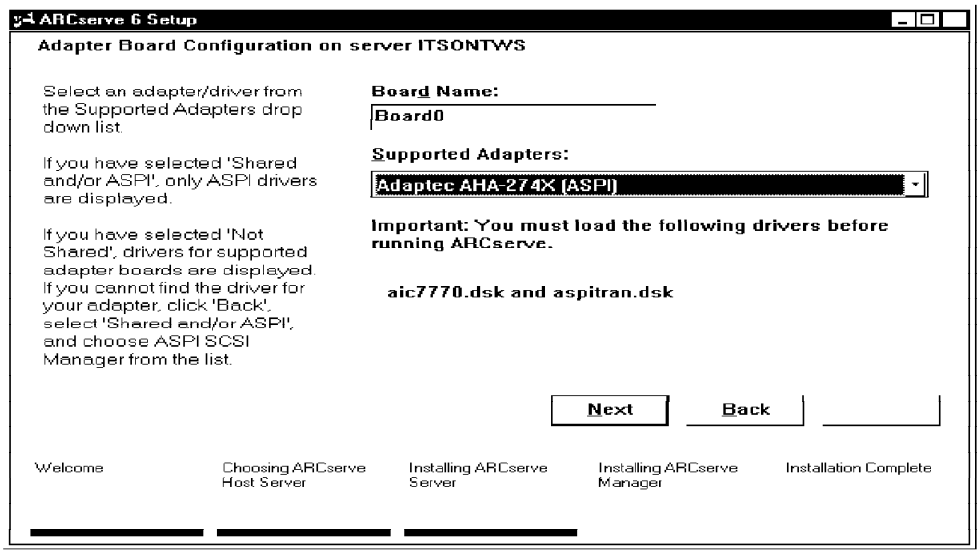


Figure 128. Select Supported Adapter

17. Click on the ″NEXT″ button on the windows displayed next until you see the following window. The window shows that the Cheyenne ARCserve 6 for NetWare installation has been successfully done. Click on the ″OK″ button.

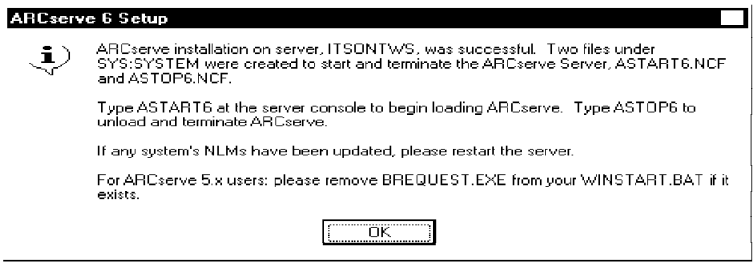


Figure 129. Successful Installation Message

Note

Do not use ASTRT6.NCF file as this window suggests. This does not run when using an Integrated PC Server.

18. To finish the installation process, click on the ″Exit″ button on the following window.

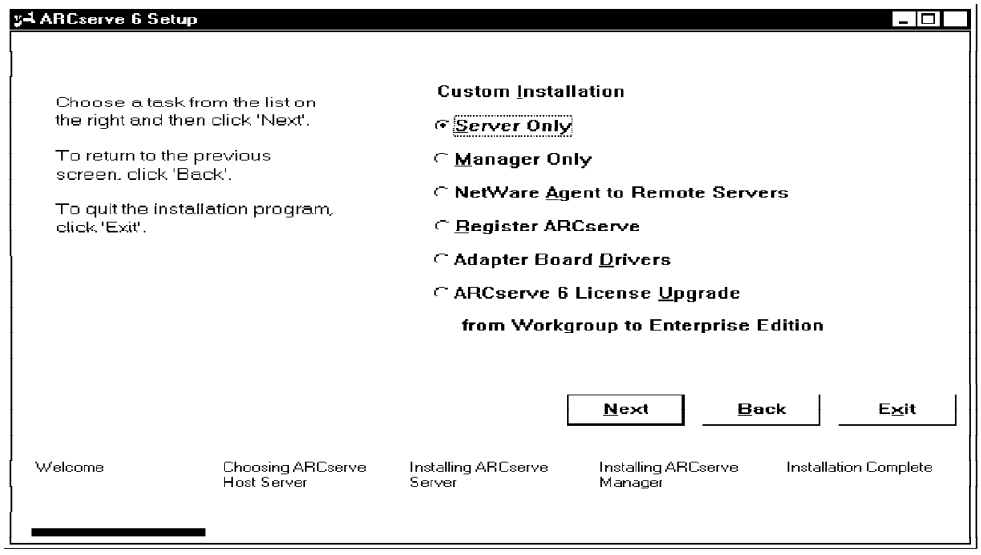


Figure 130. Exit the Cheyenne ARCserve 6 for NetWare Installation Process

19. You can now install the service packs you downloaded before starting the installation process. For instructions, see the README files that come with the service packs.

Chapter 14. OS/400 Integration for Novell NetWare and Novell NetWare 4.11

The OS/400 Integration for Novell NetWare became available at a time when Novell NetWare 4.10 was the current version of Novell NetWare. When Novell IntranetWare (including NetWare 4.11) became available, OS/400 Integration for Novell NetWare was changed to support the new version as well. Therefore, you can take advantage of the new features available in Novell NetWare 4.11 by installing Novell NetWare 4.11 on an Integrated PC Server.

The changes made to OS/400 Integration for Novell NetWare are available through PTFs. At the time this redbook was printed, informational APAR II09667 and APAR II10265 listed the PTFs necessary for OS/400 V3R7, and informational APAR II09535 and APAR II10264 listed the PTFs necessary for OS/400 V3R2.

Attention

Before you start installing Novell NetWare 4.11 on an AS/400 Integrated PC Server, be aware of the following conditions:

On an AS/400 system with multiple Integrated PC Servers running Novell NetWare, all Novell NetWare servers for a specific language on the Integrated PC Servers of that AS/400 system **must be running the same version of Novell NetWare**. You cannot intermix Novell NetWare 4.10 and Novell NetWare 4.11 on multiple Integrated PC Servers on the same AS/400 system for the same language.

14.1 New Installation of Novell NetWare 4.11 on an Integrated PC Server

If you have not previously installed Novell NetWare 4.10 on the Integrated PC Server, the installation of Novell NetWare 4.11 is basically the same as a Novell NetWare 4.10 installation. The only difference is that the source directories on the CD-ROM you are installing from are different. When you install Novell NetWare on OS/400 V3R7, you use the INSNTWSVR as shown in the following figure.

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```
                    Install NetWare Server (INSNTWSVR)

Type choices, press Enter.

Network server description . . . NWSD         > ITSCNTWF
Resource name  . . . . . . . . . RSRCNAME     > CC01
Port 1:                          PORT1
  Line type  . . . . . . . . . .               > *TRN4M
  Local adapter address  . . . .               > 497034152303
  IPX circuit information:
  IPX network number . . . . . .               > 429F2001
  Frame type . . . . . . . . . .                 *SSAP
Copy NetWare source  . . . . . . CPYNTWSRC    > *YES
Vary on configuration  . . . . . VRYCFG         *YES
IPX internal network number  . . IPXNETNBR      *RANDOM
Server message queue . . . . . . MSGQ           *JOBLOG
  Library  . . . . . . . . . . .
Network server storage space:    NWSSTG
  Name . . . . . . . . . . . . .                 *NWSD
  Size . . . . . . . . . . . . .                 200
FSIOP language version . . . . . LNGVER         *PRIMARY
Country code . . . . . . . . . . CNTRYCODE      *LNGVER
Code page  . . . . . . . . . . . CODEPAGE       *LNGVER
NetWare language:                NTWLNGID
  Language number  . . . . . . .                 4
  Language name  . . . . . . . .                 *DFT
NetWare source directory . . . . NTWSRCDIR    > '/qopt/nw411'  1
```

Figure 131. INSNTWSVR Command for Novell NetWare 4.11

1

This parameter specifies that Novell NetWare 4.11 instead of Novell NetWare 4.10 should be installed on the Integrated PC Server. NW411 is specified because it is the volume label of the CD. To find the value that needs to be specified after /QOPT/, you can type:

```
vol d:
```

where d: specifies your workstation CD-ROM drive.

Another place to specify a different source directory for Novell NetWare 4.11 is when you start RCONSOLE and enter LOAD INSTALL to continue the installation process. When copying files to disk, the following source directory path must be specified after pressing F4:

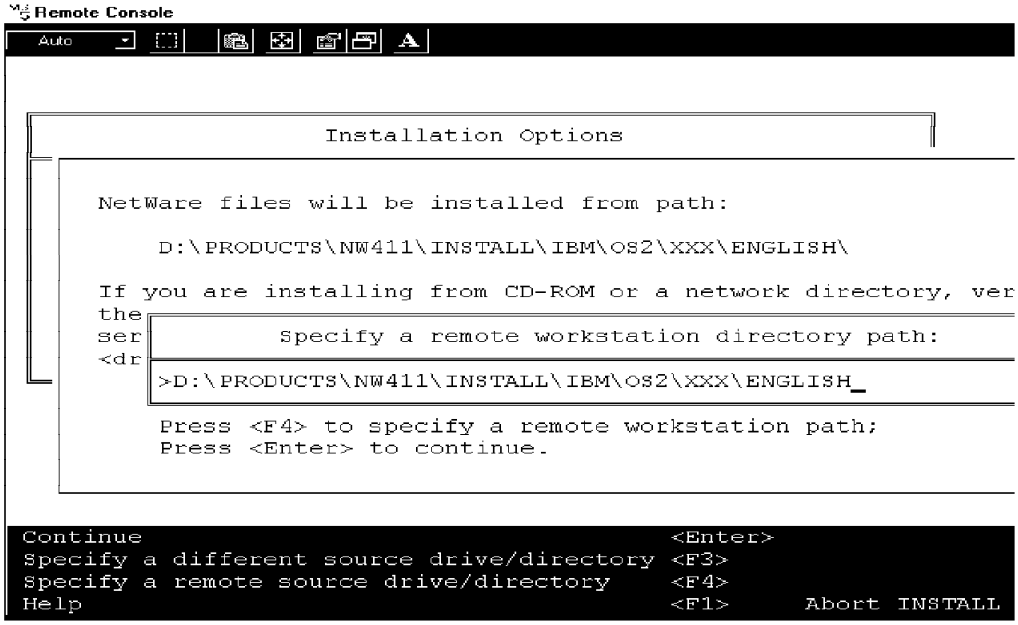


Figure 132. Novell NetWare 4.11 Source Directory Path

The ″D:″ specifies the CD-ROM drive on your workstation you are running RCONSOLE from; the rest specifies the source directory path for this phase of the installation process.

The process to install Novell NetWare 4.11 on an OS/400 V3R2 system is similar. Instead of specifying the source directory path on the INSNTWSVR command, you need an installation diskette to copy the Novell NetWare code from a Windows workstation onto the Integrated PC Server. For Novell NetWare 4.11, there is a special installation diskette; you can download the code from the Web page on the Internet.

`http://www.as400.ibm.com/products/software/netware/as4nwss.htm`

The rest of the procedure is the same as previously described for V3R7.

14.2 Upgrading Integrated PC Server from Novell NetWare 4.10 to Novell NetWare 4.11

If you already have Novell NetWare 4.10 installed on an Integrated PC Server and want to upgrade that to Novell NetWare 4.11, the procedure is a bit different and more complicated. Before starting the update procedure, look at the following points:

- All Integrated PC Servers installed in the same AS/400 system must run the same version of Novell NetWare, either 4.10 or 4.11. You cannot mix both versions on one AS/400 system for the same language. So if you have multiple Integrated PC Servers on one AS/400 system, plan to upgrade all Integrated PC Servers at the same time.
- Check if the prerequisite PTFs are installed (at the time of printing this redbook, informational APARs II09667/II10265 and II09535/II10264 list the necessary PTFs). This information is also available on the World Wide Web AS/400 NetWare home page, WWW.AS400.IBM.COM/NETARE.
- Make sure that you have a backup of all the PTFs applied to the program product 57xx-SA2, OS/400 Integration Services for FSIOP (CUM tape, save files and so on). If not, get a backup of the PTFs **before you start the upgrade process**. You need to apply these PTFs in a later step of the upgrade process.
- Make sure you have a backup copy of the program product 5716-SA2.

 Important

 The backup copy of 57xx-SA2 must have been created **before the INSNTWSVR command was ever used with the program product installed on the system.** We recommend you use the copy of 57xx-SA2 on the distribution media you received from IBM.

 The reason for this requirement is that the INSNTWSVR command changes the content of the F: drive on the AS/400 system. This F: drive (the AS/400 object name is QFPBSYS4 in library QFPINT for the primary language and QFPBSYS4 in library QSYSxxxx where xxxx is the secondary language number) is part of the program product 57xx-SA2. So when you save 57xx-SA2 **after** INSNTWSVR was run, you save the changed F: drive since that AS/400 object is part of 57xx-SA2. With the changed F: drive, the upgrade process will fail.

- Make sure that the SYS volume of every server to be upgraded has at least 70MB of free space available.
- Make sure you have a CD-ROM with the IntranetWare code.
- Make sure you have a Novell NetWare 4.11 license diskette. When upgrading a server from Novell NetWare 4.10 to Novell NetWare 4.11, you need new Novell NetWare 4.11 licenses.

If you have all of the requirements in the preceding list, you can start the installation process. Keep in mind that it takes approximately two hours to upgrade a server (not counting the backups you might want to do before starting the upgrade process (57xx-SA2, SYS volume of Integrated PC Server NetWare servers, and so on)).

14.2.1 Upgrade Process for OS/400 V3R7

The actual upgrade process is done the following way:

1. Remove the ″Read Only″ attribute of the following two modules:

 - INSTALL.NLM
 - NWSNUT.NLM

 You can do that in two different ways:

 - Using the Novell NetWare NWADMIN program to change the attributes of these two NDS objects.
 - Mapping the SYS volume of the server you are upgrading to a drive on your workstation and changing the attribute with Windows methods (Explorer, File Manager). The modules are in the SYSTEM directory of the SYS volume.

2. Using the mapped drive on your workstation, perform the following copy operations:

 - COPY D:\PRODUCTS\NW411_\411\SYSPRE\INSTALL.NLM M:\SYSTEM
 - COPY D:\PRODUCTS\NW411_\411\SYSPRE\NWSNUT.NLM M:\SYSTEM

 where D: is the CD-ROM drive of your workstation and M: is the Novell NetWare SYS: drive mapped to your workstation.

 These last two steps, changing the Read Only attributes of the two modules and copying them to the mapped SYS: drive are necessary because the installation process for Novell NetWare 4.11 must use the new modules INSTALL.NLM and NWSNUT.NLM of the 4.11 version. Since the Integrated PC Server cannot access the AS/400 CD-ROM drive, the modules cannot be loaded directly from the CD-ROM, but must be copied to the SYS: drive to be loaded from there.

3. Start RCONSOLE from your workstation and log into the server on the Integrated PC Server you are upgrading.
4. Unload the module NWSNUT. You might get the message that the module cannot be unloaded because other modules are using it. In that case, unload these modules first before unloading NWSNUT.
5. Load the module NWSNUT again with the following command:

   ```
   LOAD SYS:\SYSTEM\NWSNUT.NLM
   ```

Important

You must specify the command with the complete directory path! If you do not specify the complete path, you load the old NWSNUT module from the E: drive and the upgrade process will fail.

6. Load the Install module by entering the following command:

   ```
   LOAD SYS:\SYSTEM\INSTALL.NLM
   ```

 Important

 You must specify the command with the complete directory path! If you do not specify the complete path, you load the old INSTALL module from the E: drive and the upgrade process will fail.

7. Select the ″Copy files″ option from the install menu and press Enter.
8. Press F4 when prompted for the directory path and specify the remote path to the Novell NetWare 4.11 CD-ROM as shown in the following figure:

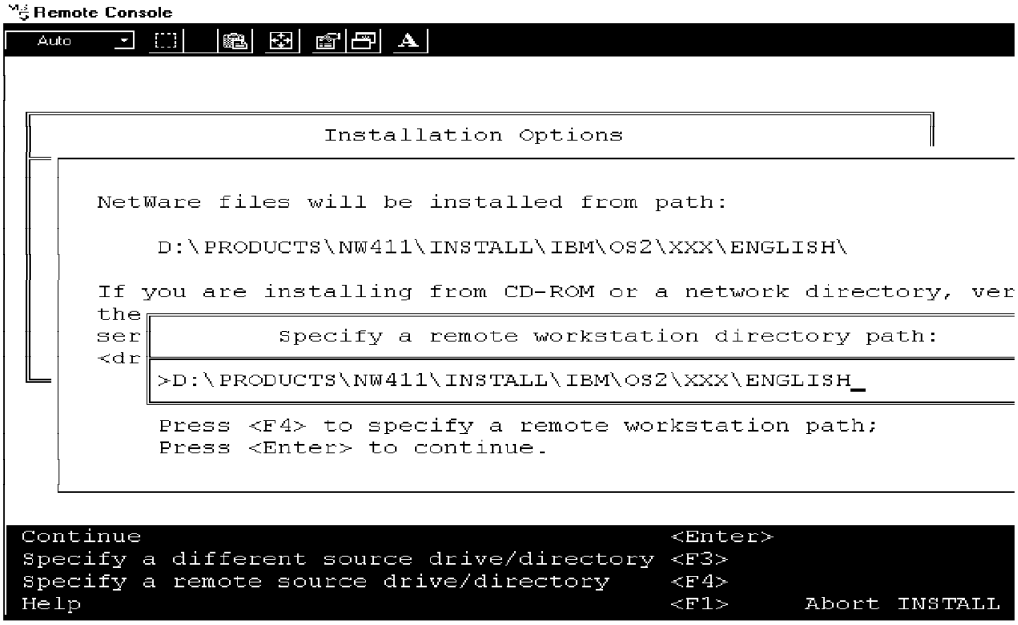


Figure 133. Novell NetWare 4.11 Source Directory Path

where D: is the drive letter for the CD-ROM drive of your workstation.

9. Press Enter when the following prompt is shown:

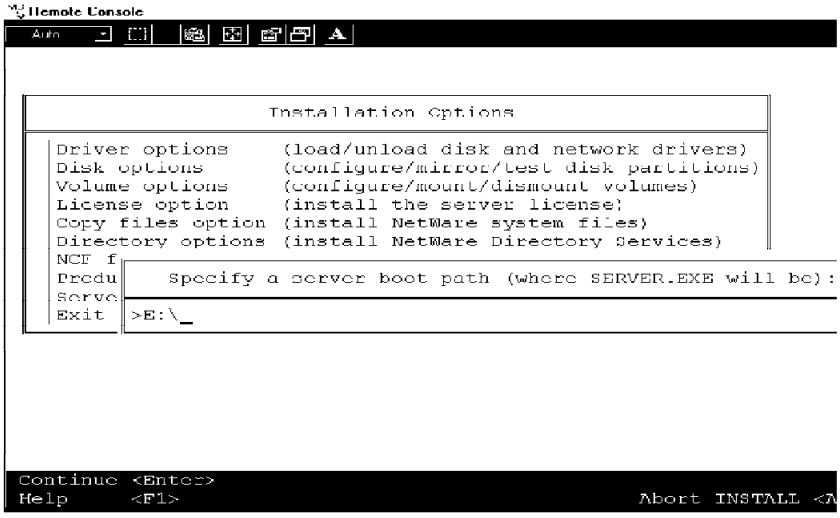


Figure 134. Specifying Server Boot Path

10. Press Enter when the following message is shown. The message is normal and does not indicate any problem:

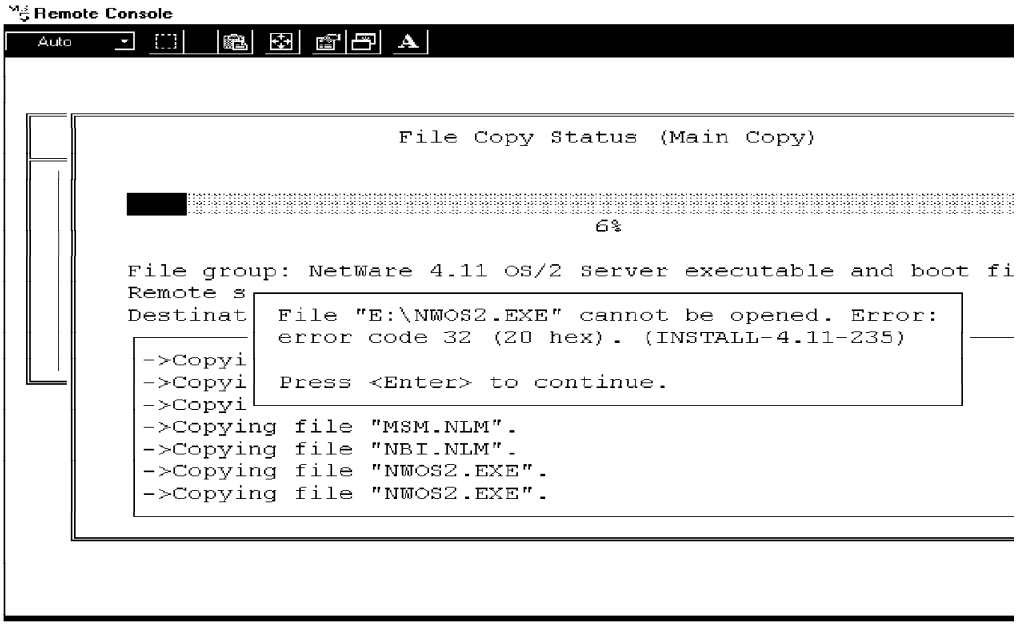


Figure 135. Error Message to Ignore

Press Enter and select the option:

`Continue copy next file.`

11. You might possibly get the following message as well. Ignore it also:

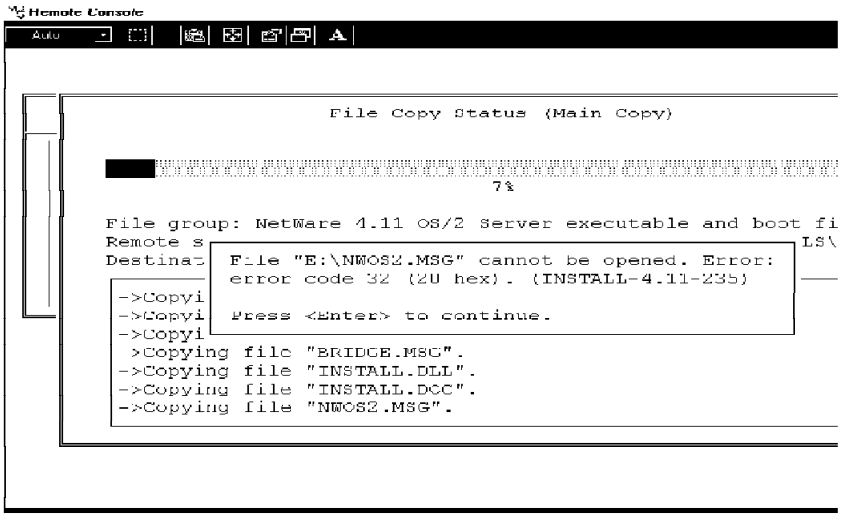


Figure 136. Error Message to Ignore

Press Enter and select the option:

`Continue copy next file.`

12. During the copy process of the files to the Novell NetWare server, you may get messages saying that a newer version of a module already exists on the SYS: volume. This can happen when the newest Novell NetWare 4.10 modules have later creation dates than the Novell NetWare 4.11 modules. The message indicates this situation. Do the following steps:
 - Press Enter. Another window is shown.
 - Select the ″Overwrite the file″ option and press Enter.
13. Select the ″License″ option from the install menu and press Enter.
14. Press F4 when you are prompted for the directory path.
15. Specify the diskette drive of your workstation as shown in the following figure and press Enter.

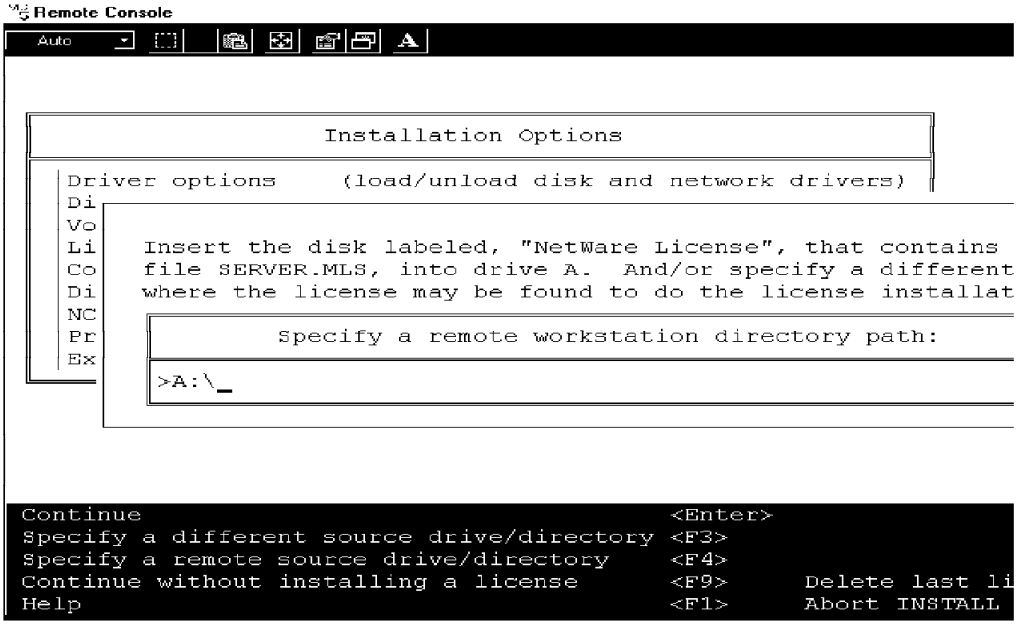


Figure 137. Novell NetWare 4.11 License Source Path

16. Perform all the preceding steps for every Novell NetWare server on the Integrated PC Servers attached to the same AS/400 system.

After you have done the previous steps for each Integrated PC Server running Novell NetWare, perform the following steps. Remember that you now need the backup copy of the program product 5716-SA2:

1. Vary off all the network server descriptions, not only the ones running Novell NetWare. You can display all network server descriptions with the following command:

   ```
   WRKCFGSTS *NWS
   ```

 Take option 2 (vary off) for all the network server descriptions that are not varied off.

2. Delete the licensed program product 5716-SA2 using the following command:

   ```
   DLTLICPGM  5716SA2
   ```

3. Re-Install the licensed program product 5716-SA2 using the backup copy described at the beginning of this chapter. It is best to use the copy provided by IBM. You can install the licensed program product using the following command:

```
RSTLICPGM 5716SA2
```

4. Apply all PTFs to the licensed program product 5716-SA2. You can do this with the following command:

```
                    Install Program Temporary Fix (INSPTF)

  Type choices, press Enter.

  Product description:            LICPGM
    Product  . . . . . . . . . .              > 5716SA2
    Release  . . . . . . . . . .                *ONLY
                          + for more values
  Device . . . . . . . . . . . . . DEV            *SERVICE
  PTF apply type . . . . . . . . . INSTYP       > *IMMDLY
  PTF omit list:                   OMIT
    Product  . . . . . . . . . .
    PTF identifier . . . . . . . .
    Release  . . . . . . . . . .                *ONLY
                          + for more values
```

Figure 138. INSPTF for 5716-SA2 PTFs

Watch the INSTYP parameter value. By default, it is set to *SRVATT, which refers to the server attributes. That might cause (depending on the server attributes) an immediate IPL of the system after installing the PTFs. This is not necessary. All of the PTFs for 5716-SA2 at this moment are immediate PTFs and do not require an IPL.

5. Now the base code of the Novell NetWare 4.11 must be installed on the AS/400 system. To do this, run the following command:

```
                      Install NetWare Server (INSNTWSVR)

  Type choices, press Enter.

  Network server description . . . NWSD         > *CPYONLY
  FSIOP language version . . . . . LNGVER         *PRIMARY
  NetWare language:                NTWLNGID
    Language number  . . . . . .                  4
    Language name  . . . . . . .                  *DFT
  NetWare source directory . . . . NTWSRCDIR    > '/qopt/nw411'
```

Figure 139. INSNTWSVR Command to Copy Novell NetWare 4.11 to AS/400 System

This command is a long-running command. In our test case, it ran approximately one hour.

6. Vary on your network server descriptions by using WRKCFGSTS *NWS and option 2.

The upgrade to Novell NetWare 4.11 is now complete. The network server description should become active after some time (it may take 10 minutes).

14.2.2 Upgrade Process for OS/400 V3R2

The upgrade process for an AS/400 system with OS/400 V3R2 is about the same as for OS/400 V3R7, so you can follow the description given in Section 14.2.1, “Upgrade Process for OS/400 V3R7” on page 195. There is, however, one important exception:

Since an AS/400 system running OS/400 V3R2 does not have a CD-ROM drive, the last step described in Section 14.2.1, “Upgrade Process for OS/400 V3R7” on page 195 (copying the Novell NetWare 4.11 code to the AS/400 system using the INSNTWSVR with a network server description parameter value of *CPYONLY) cannot be done on a system with OS/400 V3R2 installed.

So, when you come to that point in the upgrade procedure where you issue the command INSNTWSVR NWSD(*CPYONLY) in OS/400 V3R7 to install the Novell NetWare 4.11 code on an AS/400 system running OS/400 V3R2, you must use the following procedure:

1. Create a temporary network server description with the resource name of your ″production″ server you are just now upgrading to Novell NetWare 4.11.

```
                      Install NetWare Server (INSNTWSVR)

  Type choices, press Enter.

  Network server description . . . NWSD         > DUMMY
  Resource name  . . . . . . . . . RSRCNAME     > CCO4
  Port 1:                          PORT1
    Line type  . . . . . . . . . .              > *TRN4M
    Local adapter address  . . . .              > 497034152382
    IPX circuit information:
    IPX network number . . . . . .              > 429F2001
    Frame type . . . . . . . . . .                *SSAP
  Vary on configuration  . . . . . VRYCFG         *YES
  IPX internal network number  . . IPXNETNBR      abcdef01
  Server message queue . . . . . . MSGQ           *JOBLOG
    Library  . . . . . . . . . . .
  Network server storage space:    NWSSTG
    Name . . . . . . . . . . . . .                *NWSD
    Size . . . . . . . . . . . . .              > 100
  FSIOP language version . . . . . LNGVER         *PRIMARY
```

Figure 140. INSNTWSVR Command for Temporary Network Server

2. Wait until the status of the network server description is ″Vary on Pending″. You can check that with the following command:

   ```
   WRKCFGSTS *NWS
   ```

 It may take some time until the network server description status changes to ″Vary on Pending″; up to 10-15 minutes is normal.

3. When the status of the temporary network server description has changed to ″Vary on Pending″, you can use that temporary server to do the workstation installation as documented in Chapter 2 of *OS/400 Integration for Novell NetWare*, SC41-3124-01.

 This installation process requires a Windows 3.1x workstation connected to the same LAN segment the AS/400 system is connected to. That workstation must have a CD-ROM drive. By using the diskette mentioned at the beginning of this chapter (the one you can download from the Internet) and inserting the Novell NetWare 4.11 CD-ROM into the CD-ROM drive of the workstation, the Novell NetWare 4.11 code is transferred to the AS/400 system over the LAN.

4. When transferring the files from the workstation to the AS/400 system is finished, you can vary off the temporary network server description.

5. After varying off the network server description, you may delete the temporary network server description and all of the objects created with the INSNTWSVR command. The objects/ definitions created are:

 - Network server description. To access, use the OS/400 WRKNWSD command.
 - Network server storage space. To access, use the OS/400 WRKNWSSTG command.
 - A LAN line description. To access, use the OS/400 WRKLIND command.
 - An IPX description. To access, use the OS/400 WRKIPXCCT command.
 - An IPX circuit definition
 - Server storage spaces xxxxxx1 and xxxxx3 in QUSRSYS, where xxxxx stands for the network server description name that is deleted when the network server description is deleted.

 The names of all these objects/definitions start with the name of the temporary network server description you created with a number appended if necessary to ensure uniqueness. Not all of these objects/definitions are automatically deleted when the network server description is deleted, so you may want to check and delete them manually to avoid wasting disk space.

6. Vary on the ″production″ network server you just upgraded to Novell NetWare 4.11. This completes the upgrade process. The network server description should become active after some time (it may take 10 minutes).

Appendix A. Special Notices

This publication is intended to help IBM specialists and business partners, as well as customers, to set up their systems such that the AS/400 system and NetWare can productively work together. The information in this publication is not intended as the specification of any programming interfaces that are provided by OS/400, NetWare Integration for OS/400, or Enhanced NetWare Integration for AS/400. See the PUBLICATIONS section of the IBM Programming Announcement for OS/400 and NetWare Integration for OS/400 for more information about what publications are considered to be product documentation.

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Appendix B. Related Publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this redbook.

B.1 International Technical Support Organization Publications

For information on ordering these ITSO publications see “How to Get ITSO Redbooks” on page 209.

- *Client Access/400 for Windows 3.1 Coexistence with Novell NetWare 4.1 and FSIOP*, SG24-4666
- *Inside Client Access/400 for Windows 3.1 Version 1 Release 1 Modification 1*, SG24-4429
- *Inside AS/400 Client Access for Windows 95/NT Version 1 Release 1 Mod. 2*, SG24-4748

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Application Development Redbooks Collection	SBOF-7290	SK2T-8037
Personal Systems Redbooks Collection	SBOF-7250	SK2T-8042

B.3 Other Publications

These publications are also relevant as further information sources:

- *OS/400 Integration for Novell NetWare*, SC41-3124
- *Integrating AS/400 with Novell NetWare*, SC41-4124

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- **IBM Direct Publications Catalog on the World Wide Web**

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Index

A

add circuit service information 24
Add NetWare Authentication Entry (ADDNTWAUTE) command 94
ADDNTWAUTE (Add NetWare Authentication Entry) command 94
AS/400 line description 17
AUTOEXEC.NCF 158

B

backup option 149
bibliography 207

C

Change IPX Description (CHGIPXD) command 23
Change User Profile (CHGUSRPRF) command 96
changing
 ipx description 23
 user profile 96
Cheyenne ARCserve 6 for NetWare 157
 installing 180
CHGIPXD (Change IPX Description) command 23
CHGUSRPRF (Change User Profile) command 96
circuit route information 22
command
 Add NetWare Authentication Entry (ADDNTWAUTE) 94
 ADDNTWAUTE (Add NetWare Authentication Entry) 94
 ENDIPX (End IPX) 26
 INSNTWSVR 44, 50, 62
 INSNTWSVR (Install NetWare Server) 49, 68
 Install NetWare Server (INSNTWSVR) 49, 68
 STRIPX (Start IPX) 26
 Work with IPX Status (WRKIPXSTS) 28
command, CL
 Change IPX Description (CHGIPXD) 23
 Change User Profile (CHGUSRPRF) 96
 CHGIPXD (Change IPX Description) 23
 CHGUSRPRF (Change User Profile) 96
 Create IPX Description (CRTIPXD) 23
 Create Output Queue (CRTOUTQ) 129
 CRTIPXD (Create IPX Description) 23
 CRTOUTQ (Create Output Queue) 129
 Display Optical (DSPOPT) 48, 68
 Display Software Resources (DSPSFWRSC) 47, 67
 DSPOPT (Display Optical) 48, 68
 DSPSFWRSC (Display Software Resources) 47, 67
 Restore (RST) 150
 Restore Licensed Program (RSTLICPGM) 62
 RST (Restore) 150
 RSTLICPGM (Restore Licensed Program) 62
 SAV (Save) 150
 Save (SAV) 150
 Save Object (SAVOBJ) 150
 SAVOBJ (Save Object) 150
 Start Remote Writer (STRRMTWTR) 128, 131
 STRRMTWTR (Start Remote Writer) 128, 131
 Work with (WRKLNK) 143
 Work with Configuration Status (WRKCFGSTS) 49, 59, 68, 74
 Work with Hardware Resources (WRKHDWRSC) 44, 63
 WRKCFGSTS (Work with Configuration Status) 49, 59, 68, 74
 WRKHDWRSC (Work with Hardware Resources) 44, 63
 WRKLNK (Work with) 143
common name 36
configuration status
 working with 49, 59, 68, 74
container object 34
CPYNTWSRC parameter 46, 66
Create IPX Description (CRTIPXD) command 23
Create Output Queue (CRTOUTQ) command 129

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creating
 ipx description 23
 output queue 129
CRTIPXD (Create IPX Description) command 23
CRTOUTQ (Create Output Queue)
 command 129

D

Display Optical (DSPOPT) command 48, 68
Display Software Resources (DSPSFWRSC)
 command 47, 67
displaying
 optical 48, 68
 software resources 47, 67
distinguished name 35
documentation, installing the novell netware
 online 177
DSPOPT (Display Optical) command 48, 68
DSPSFWRSC (Display Software Resources)
 command 47, 67
dual purpose adapter 3

E

effective rights 38
ENBNLSP parameter 23
End IPX (ENDIPX) command 26
ENDIPX (End IPX) command 26

F

frame type 45, 65

H

hardware requirement 7
 NetWare server 9
hardware resources
 working with 44, 63

I

IFS (integrated file system) 141
inherited rights 38
INSNTWSVR (Install NetWare Server)
 command 49, 68
INSNTWSVR command 44, 50, 62
Install NetWare Server (INSNTWSVR)
 command 49, 68
INSTALL.NLM module 195
installing
 applications on Integrated PC Server 177
 Cheyenne ARCserve 6 for NetWare 180
 Novell Netware on CISC 41
 Novell NetWare online documentation 177
installing workstation 50
integrated file system (IFS) 141
integrated PC server 3
 upgrading 193
integration for NetWare 4
internetwork packet exchange (IPX) 12
IPX (internetwork packet exchange) 12
IPX addressing 13
IPX architecture 11
IPX circuit for LAN 18
IPX circuit for WAN 21
IPX configuration 15
IPX description 15
 changing 23
 creating 23
IPX network number 45, 64
IPX protocol stack 11
IPX routing 25
IPX support 6, 11
IPXNETNBR parameter 46, 66
IPXPKTFWD parameter 23
IPXRTGPCL parameter 23

L

leaf object 35
licensed program
 restoring 62
line description, AS/400 17
line type 44
LNGVER parameter 47, 66
local adapter address 45, 64

N

name type 36
naming convention 35

NCP (netware core protocol) 13
NDS (NetWare directory services) 31
NDS security 37
NDS tree 32
NetWare Administrator Utility 54, 70
netware core protocol (NCP) 13
NetWare directory services (NDS) 31
netware link services protocol (NLSP) 13
NetWare Remote Console 55, 70
NetWare server hardware requirement 9
NLSP (netware link services protocol) 13
Novell NetWare 4.11 191
Novell NetWare 4.11 license 194
Novell NetWare directory services 31
Novell NetWare on RISC platform 61
Novell NetWare server 9
NTWLNGID parameter 47, 67
NTWSRCDIR parameter 48, 68
NWSNUT.NLM module 195
NWSSTG parameter 46, 66

O

object
 container 34
 leaf 35
 properties 36
 rights 37
 root 33
 saving 150
online documentation 177
optical
 displaying 48, 68
option
 backup 149
 restore 149
OS/400 Integration for Novell NetWare 191
output queue
 creating 129

P

parameter
 CPYNTWSRC 46, 66
 ENBNLSP 23
 IPXNETNBR 46, 66
 IPXPKTFWD 23
parameter *(continued)*
 IPXRTGPCL 23
 LNGVER 47, 66
 NTWLNGID 47, 67
 NTWSRCDIR 48, 68
 NWSSTG 46, 66
 RIPSTATE 23
 RSCRCNAME 44
 SAPSTATE 23
 VRYCFG 46, 66
performance considerations 175
port number 44, 64
property rights 37

R

relative distinguished name 35
remote writer
 starting 128, 131
requirement
 hardware 7
 software 8
Restore (RST) command 150
Restore Licensed Program (RSTLICPGM) command 62
restore option 149
restoring
 licensed program 62
RIP (routing information protocol) 12
RIPSTATE parameter 23
RIPSTATE value 24
root object 33
routing 23
routing information protocol (RIP) 12
RSRCNAME parameter 44
RST (Restore) command 150
RSTLICPGM (Restore Licensed Program) command 62

S

SAP (service advertising protocol) 13
SAPSTATE parameter 23
SAV (Save) command 150
Save (SAV) command 150
Save Object (SAVOBJ) command 150

saving
 object 150
SAVOBJ (Save Object) command 150
SBACKUP 155
sequenced packet exchange (SPX) 12
service advertising protocol (SAP) 13
software prerequisite 8
software requirement 8
software resources
 displaying 47, 67
SPX (sequenced packet exchange) 12
Start IPX (STRIPX) command 26
Start Remote Writer (STRRMTWTR)
 command 128, 131
starting
 remote writer 128, 131
STARTUP.NCF 158
STRIPX (Start IPX) command 26
STRRMTWTR (Start Remote Writer)
 command 128, 131
STRSBKSRV program 159

T

tape pipe 149
tape pipe support 151

U

upgrade process 194
 for OS/400 V3R2 201
 for OS/400 V3R7 195
upgrading
 Integrated PC Server 193
user profile
 changing 96

V

VRYCFG parameter 46
VRYCFG paraneter 66

W

Work with (WRKLNK) command 143
Work with Configuration Status (WRKCFGSTS)
 command 49, 59, 68, 74
Work with Hardware Resources (WRKHDWRSC)
 command 44, 63
Work with IPX Status (WRKIPXSTS)
 command 28
working with
 configuration status 49, 59, 68, 74
 hardware resources 44, 63
workstation client 6
workstation, installing 50
WRKCFGSTS (Work with Configuration Status)
 command 49, 59, 68, 74
WRKHDWRSC (Work with Hardware Resources)
 command 44, 63
WRKIPXSTS (Work with IPX Status)
 command 28
WRKLNK (Work with) command 143

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